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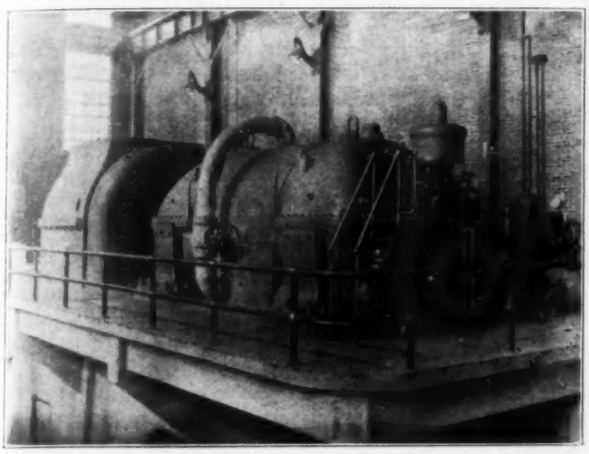
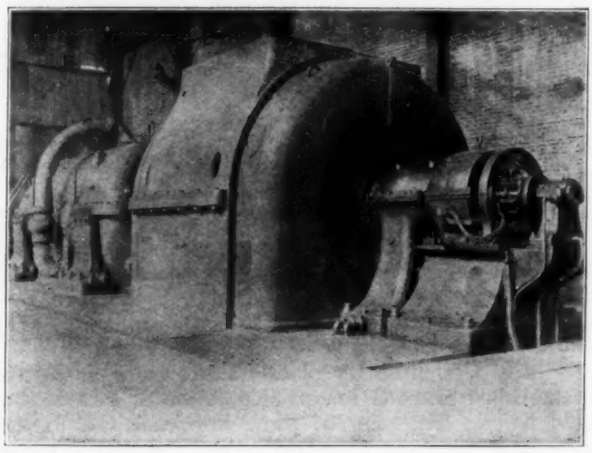




Figs. 1 and 2.—The 25,000-Kilovolt-Ampere Turbo Unit at Warrior Steam Plant. Turbine and Generator Ends of the Largest Generating Unit in the South.

Warrior Steam Plant of Alabama Power Company

Second Auxiliary Plant to Hydroelectric System to Be Enlarged for Government's Power Needs—Location at Coal Mine—Largest Generating Units in the South

By W. B. WEST

PRIOR to August, 1917, the Alabama Power Company, operating in northern Alabama with headquarters at Birmingham, generated most of its power at Lock No. 12 on the Coosa River, 50 miles below Birmingham, and had only a 10,000-kilowatt steam plant in reserve. This plant is located at East Gadsden, Ala.

At Lock No. 12 there are five 13,500-kilovolt-ampere vertical water-wheel generators. When the river gets low these generators cannot carry the load and it was seen that the East Gadsden plant would soon be too small to carry enough load to take care of an emergency. The company officials, therefore, decided to construct another steam plant on the banks of the Warrior River, about 40 miles northwest of Birmingham, to be held in reserve.

However, by the time the first unit in this plant was started the load in the Birmingham district and at Gadsden and Anniston had become so large as to make it necessary to put it into operation at once.

Plant Assumes National Importance.

Since that time the Government has decided to use power generated at this plant for the operation of its industries at Muscle Shoals on the Tennessee River (near Sheffield, Ala.) until the $12,000,000 dam and hydroelectric plant at that place is completed. Construction crews are hastening the completion of the intervening transmission line.

The Warrior power plant, in order to serve the Government projects, will be enlarged and extended at an initial cost of $3,000,000.

The size of the new units to be installed has not yet been determined. It is certain, however, that each will have a capacity of over 25,000 kilovolt-amperes.

It is interesting to note that this plant is at an apex of a large imaginary triangle, whose sides inclose the Birmingham district. Lock No. 12 is at another apex and the East Gadsden plant is at the third apex. While most of the load is still carried by the Lock No. 12 plant, it is necessary to keep the Warrior River plant in operation except during high water on the Coosa River.

The location of the new plant was determined largely by the available supply of coal and water. Ground was broken early in July, 1916, and in spite of the congested freight situation and manufacturing delays, the first unit was started in August, 1917.

Fig. 3.—General View of Warrior Station.

While not a record performance, yet, in view of the fact that the main equipment was much delayed owing to misunderstandings in the design of the turbogenerator, it compares well with similar installations even in less active periods.

In general plan, the plant follows quite closely the established practice for an installation of its size, but the unique treatment of some important details and its importance in the Government service justifies special description.

The foundations are carried down to bed rock which lies fairly level about 14 feet below grade. The basement walls of the turbine room and the walls of the cold well are carried down to rock, which is below river water level; but in the boiler room the columns are carried on piers founded on rock.

Location Close to Coal Mine.

The fact that coal is mined only a few hundred yards up the river from the plant is one of its most striking features. This plan of locating a power plant at the mouth of a coal mine has been advocated by many of the leading engineers, but as yet very few plants have been so located.

After leaving the mines the coal is carried to the crusher in tram cars drawn by an electric locomotive. From the crusher it is delivered upon a 24-inch belt conveyor driven from the lower end. The belt conveyor discharges into a steel bunker having a capacity of 600 tons. From the bunker the coal passes into the automatic registering scales. Each stoker is equipped with two sets of scales. The total weighing capacity of the 12 scales is 9600 pounds per minute. Ordinarily the daily coal consumption is about 450 tons, although this will, of course, be increased greatly when more units are installed.

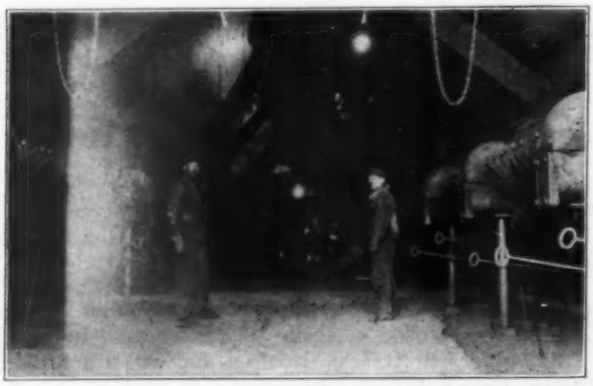


Fig. 4.—View in Boiler Room, Showing Automatic Stokers.

Principal Equipment.

The boiler room at present is 86 by 120 feet in the clear and accommodates six Babcox & Wilcox boilers, each of 1200 normal rated horsepower and designed for 150 degrees superheat. Five of the stokers are of the Westinghouse underfeed type. The other is the Combustion Engineering Corporation's type E. All the stokers are driven by two Westinghouse steam engines.

Water for boiler feed is drawn from the condenser discharge canal and is measured by Venturi meters. Centrifugal feed pumps are used. The boiler piping follows the usual lines.

At present the turbine room is 40 by 80 feet in the clear and is served by a 60-ton overhead crane. In order to make room for the two additional units which are to be installed at once for the Government, the turbine room will be enlarged to 258 by 40 feet. Another crane larger than the one in use at present will also be installed.

At present there is one 25,000-kilovolt-ampere Westinghouse turbogenerator served by a LeBlanc jet condenser located in the basement. Circulating water

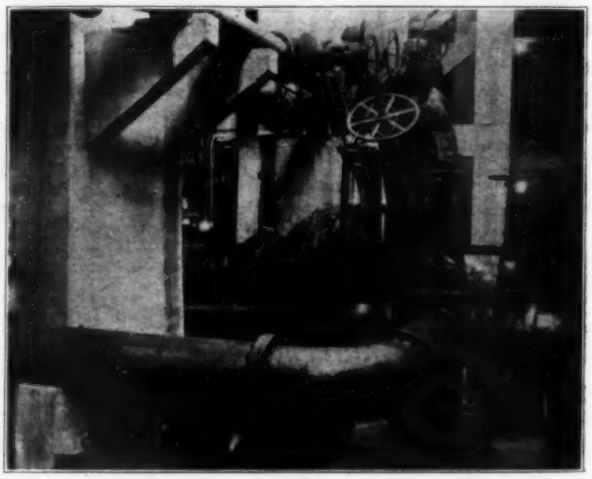


Fig. 5.—Condensing Equipment for Main Unit.

is pumped from the river and goes back by force of gravity. The generator is cooled by means of a motor-driven blower located in the basement.

The principal electrical equipment consists of one main generator with direct-connected exciter, a motor-generator exciter set and a turbine-driven exciter. The latter also supplies direct-current power for the locomotive that hauls coal from the mines to the plant. It is a 100-kilowatt, 230-volt machine making 3600 revolutions per minute. The main generator speed is 1800 revolutions per minute. Its current is three-phase, 60-cycle, generated at 6600 volts, and is stepped up to 45,000 volts for distribution.

The switching system consists of duplicate buses with remote-controlled solenoid-operated oil switches. The feeder circuits are equipped with three-phase aluminum-cell lightning arresters.

The whole installation was designed and constructed by the company's engineers and construction department, O. G. Thurlow, chief engineer, and J. A. Sernit, chief electrical engineer, having charge of the work. A. R. Gilchrist is immediately in charge of construction.

Water Pumping by Electric Power

Discussion of Characteristics of Motor-Driven Pumps and Suggestions for Selection of Pumps for Municipal Water Pumping—Paper Read Before Ohio Central-Station Men

By R. L. YATES

Assistant Manager, Platt Iron Works, Dayton, Ohio.

MUNICIPAL pumping installations will be considered as they offer more problems for solution than industrial installations, and any statements that may be made will then be applicable for both. The different sources of water supply, the leading of this supply to the pumping plant, the pumping plant and equipment itself, and the distribution system wherein it may affect the pumping units or plant will be considered briefly, the pumping equipment being discussed more fully.

I will attempt to view these problems from the standpoint of a power engineer. He may be analyzing possible pumping conditions in either a preliminary or final study. I will discuss those points, which may, in my opinion, be most pertinent to the best solutions for the service of our customers.

Water Consumption or Demand.

The desired capacity for a pumping plant may be a known quantity, or it may have to be based upon statistics derived from similar conditions or by judgment based upon possible future conditions. This knowledge is of first importance, and may require considerable study for its determination and perhaps the services of a consultant.

Industrial pumping requirements are usually easily determinable, being fixed by the capacities of certain machines or processes. Again, the capacities to be handled are closely constant over fixed periods of operation, and the problems presented simple. There are no general rules to be stated here for such requirements.

Municipal pumping capacities are much more complex in determination, and the demand for that capacity is a variable quantity. Not only may the demand be widely different for different periods in the day, but also widely variable by seasons. There are no definite rules applicable to all municipalities, but a few figures from tests and statistics may be of assistance in coming to a judgment as to proper capacities.

The per capita consumption in United States cities and towns ranges approximately from 30 to 400 gallons per day. It is quite safe to say that the average is less than 100 gallons per day; in fact, the average of 16 middle west cities is approximately 75 gallons per day per person. The average for small cities and towns is often less. Exact data to be used cannot be given, as each city or town is to a great extent a law unto itself, the character of industries and other local conditions having important influences.

Average detailed water consumption for different purposes can be taken approximately as follows: Water for sprinkling 100 square feet of lawn, 8 to 15 gallons, the latter figure showing a soaked condition; standard lawn sprinklers will discharge from 300 to 500 gallons per hour, depending upon make and pressure; to flush closet each time 5 gallons; to fill an ordinary lavatory 1½ gallons; to fill an ordinary bath tub about 30 gallons; to do an average family washing 150 to 300 gallons; for kitchen purposes 5 to 15 gallons per day. Consumption of water by animals may be approximated as follows: Horses each 5 to 10 gallons per day; cattle each 7 to 12 gallons per day; hogs 2 to 3 gallons per day; sheep 1 to 2 gallons per day. When water is used for irrigation, a detailed study should be made of same, as the consumption varies with crops and localities.

It is suggested in determining upon a capacity for a municipal pumping plant, that all available statistics from nearby plants be consulted, as this would form the most valuable basis for judgment, the maximum and minimum demands being known.

The maximum demands on a pumping plant usually appear in the summer months, and generally be-

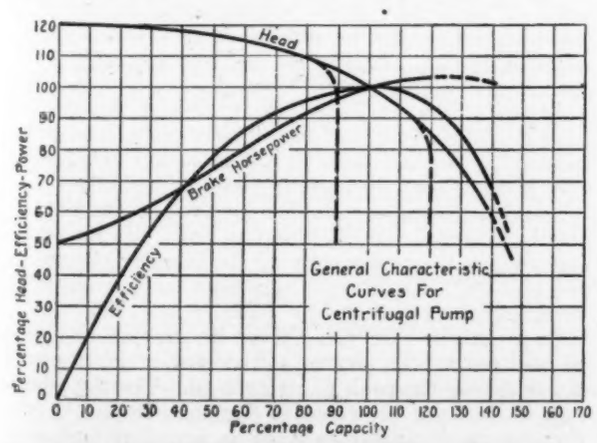


Fig. 1.—General Characteristic Curves for Centrifugal Pumps.

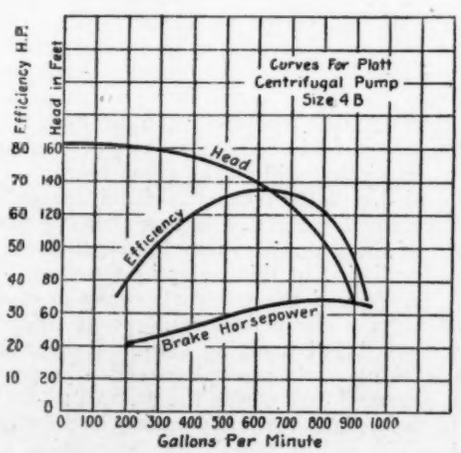


Fig. 2.—Characteristic Curves for Platt Centrifugal Pump, Size 4B.

tween the hours of 5 to 8 in the evening when lawns are being sprinkled.

It is difficult to fix upon any ratios that might exist between minimum, normal and maximum demands, as these demands are to so great an extent developed by local conditions. For a preliminary study, however, it can be assumed that the minimum demand will be approximately one-third of the maximum, and that the normal demand will be approximately two-thirds of the maximum. In other words, should preliminary calculations show that a maximum demand of 600 gallons per minute rate is required, it can then be assumed that the range of operation during the day will be from, say, 200 to 600 gallons per minute, with the normal operating rate being 400 gallons per minute.

Source of Water and Pumping-unit Location.

The usual sources of water are from a reservoir, lake, river, or a system of wells. Open water sources, such as a reservoir or river, present very few complex problems as the aqueducts or suction pipes leading to the pumps are known quantities.

When wells must be resorted to, unknown factors enter. The permanency of supply is questionable; the strata leading to the well may in time become clogged; the well screens may be choked with fine sand or other materials; the water table may be lowered in use to such an extent as to make ineffective the proper handling of quantity by the pumps, it not being possible to anticipate the exact levels that will obtain.

It is advisable with any source of supply to locate the pumping units within a proper vertical suction distance of the source of supply and to permit short suction pipes. A horizontal installation is considered by all means preferable, and is generally possible for use when the pump floor can be placed within 15 to 18 vertical feet from the water supply. A vertical installation can be used, when the suction lift for a horizontal installation would be greater than that named above, the water end of the pump being located in a pit at, say, the suction water level, the power end being located at the surface. The main disadvantage of such a unit is the inaccessibility to the water end and the probable lack of attention given.

The use of wells as a source of supply often presents difficulties in proper pump location, due to either the depth or the spread of the wells. Some engineers have solved this by the use of air-lift pumps. An air-lift pump is an apparatus for raising water from wells by means of compressed air forced to the bottom of a properly submerged pipe, allowed to expand in the pipe, and then by continuous process lifting the water to the surface. The detail construction of such an equipment and the operation can be had from any manufacturer of air compressors upon request, and further description will not be given here.

The air-lift system has the disadvantage of low efficiency, which generally is less than 30 per cent; aeration of the water also may hinder to great extent the further lifting of this water by the main pressure pump; aeration of the water also may promote erosion of parts. The main advantage of using an air lift in a municipal pumping station is its reliability, as no working parts are submerged. In general, it can be assumed that where the pump can be located close to the wells, a vertical pumping installation, even in a deep pit, will be found more economical and less expensive initially than the air lift; also, when the main pressure pumps cannot be located close to the wells, that a careful study be made as to the comparative initial and operating cost between separate vertical suction pumps located at the wells and the air-lift system.

The influence of suction conditions on pump operation is considered later.

Distributing System.

The choice and design of the proper distributing system for a given municipal installation is a study in itself and the discussion of same will not be taken up here. The choice of equipment for the pumping plant, however, is dependent to a very great extent upon the method used for the distribution of water and, so that we can refer to these systems later, we will define the type of distributing system ordinarily used.

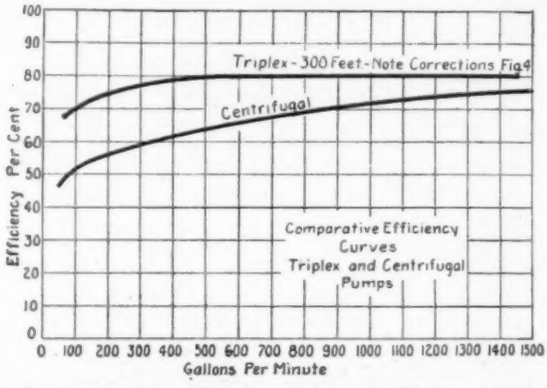

Triplex - 300 Feet - Note Corrections Fig 4
Centrifugal
Comparative Efficiency Curves Triplex and Centrifugal Pumps
Efficiency Per Cent
Gallons Per Minute
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
0 10 20 30 40 50 60 70 80 90 100

Fig. 3.—Comparative Efficiency Curves of Triplex and Centrifugal Pumps.

A direct system of distribution may include only the furnishing of the customer with water direct from the pumping units and through proper piping.

A direct system again may be as described above, but augmented with compressed-air tanks located in the pumping station, these tanks to act as accumulators or governors to relieve the pumping units of the otherwise heavy duty that would be imposed upon them.

A direct system again can be as described in the above, but augmented by a storage supply, in a stand pipe or reservoir, this stand pipe again acting as a governor for the pumping station to relieve the pumping units of the otherwise excessive duty. This system gives very excellent results with the added assurance of a storage supply during such times as the pumping units may be out of service for repair or other reasons. The size of the storage tank is determined to a great extent upon the location of same; authorities, however, seem to agree that the smallest tank that should be used would be about 30,000-gallon capacity. The size of such a tank would be about 13 feet in diameter by 20 feet in effective height.

A distributing system fed by storage entirely, instead of direct from the pumping units, has its advantages when the topography of the country permits of the building of a tank or reservoir large enough for these purposes and at low initial cost. The size of such a tank or reservoir should be such as to permit of its feeding the city or village for at least 4 to 6 hours during the peak pumping load. The big advantage in this type of system is that the pumping station then becomes similar to what is found in industrial work; the pumps will be operating under constant

capacities, started and stopped by automatic means; the pumps will be operating at their most economical points at all times in service, and therefore the attention or supervision given to such a plant would be of minimum cost.

In most municipalities two different pressures for pumping are usual, one for domestic service, the other for fire service. The amounts of these pressures are dependent upon the local conditions. The ratios, however, usually are as 60 is to 100, domestic pressures being 60 pounds, fire pressures being 100 pounds. Underwriter requirements call for 100 pounds. Mention is made of these pressures at this time, as they will affect the choice of pumping units discussed later.

Pumping Equipments.

The choice and application of pumping equipments for particular service merits a study which in many cases is not given. Many troubles which develop in pumping equipments are inherent in the pump itself. However, I believe it to be a conservative statement in saying that 90 per cent of the troubles had with pumping equipment is due either to an improper choice, an improper setting, or an improper operation of the pump. In other words, the troubles are local ones.

Manufacturers are not in a position to, and should not have to, handle the engineering necessary for a pumping installation. It should be considered their province to inform the public as to the operating characteristics of the pumping equipment they manufacture, and the problem for its proper application should then be put up to the customer, his engineer, or we perhaps may say the power engineer of the central station.

In view of the above statements we will discuss pumps, their operating characteristics, and application, limiting the discussion to installations which are electrically operated.

Electrically operated pumps can be of either the reciprocating or centrifugal types. Both types have been used by municipal and industrial concerns for many years; however, it is only within the last few years that the subject of plant analysis and economy have had serious consideration. This is particularly so in connection with the centrifugal type of pump, which is even now still in a state of development.

Reciprocating pumps are built with three plungers, two plungers, or a single plunger, and known, respectively, as triplex, duplex, single or simplex types of power pumps. The triplex pumps are in common use in all plants, where the capacities are moderate. Duplex pumps are used in plants where the conditions are special and call for large capacities, these pumps are usually special in design. Single pumps of the power-driven type are seldom used. Triplex pumps would be used for large capacities also excepting for the fact that the water end for the duplex pump, as ordinarily furnished on a steam pumping unit, can be adapted for power-driven equipments and therefore creates the least development expense for any given installation.

Standard triplex pumps can be obtained from all of the larger pump manufacturers in all sizes up to that represented by a 16-inch diameter plunger and 15-inch stroke, the approximate capacity in gallons of such a pump being 1,500 gallons per minute, or 3,200,000 gallons per day. Manufacturers' standards are designed usually for pressures varying from 90 to 150 pounds and therefore these standard equipments become applicable both in size and strength for the ordinary conditions of service found in small municipalities.

These pumps are also built in both the single and double-acting types, the former type of plunger pumping water on its downward stroke only, the latter on both its downward and upward strokes. The latter type, although less expensive for a given capacity, may become much more expensive in operation, as the design necessitates the use of an inside-packed piston and therefore very little is known as to the slippage that constantly occurs past this piston. In the single-acting type of pump, the plunger extends through a stuffing box; therefore the stuffing box is easily accessible and adjustable.

The duplex type of the reciprocating pump is furnished, as stated above, for capacities greater than, say, 2,000,000 gallons per day, and becomes a special installation. The operating characteristics of this pump follow so closely those of the triplex pump, that we will not discuss same further here.

A modern centrifugal pump for high-economy work is generally built and parts carried in stock, in sizes up to a capacity of 5000 gallons per minute or an equivalent of about 7,000,000 gallons per day. These pumps are built both in the single and multi-stage types and therefore cover a range of operations generally much greater, both in capacity and pressure, than called for by the ordinary size municipality. The smaller sizes of centrifugals are usually designed to operate under a maximum head of 150 feet in a single stage, and when operating at a speed of 1750 revolutions per minute, which usually is the maximum speed for 60-cycle current. The larger sizes of centrifugals

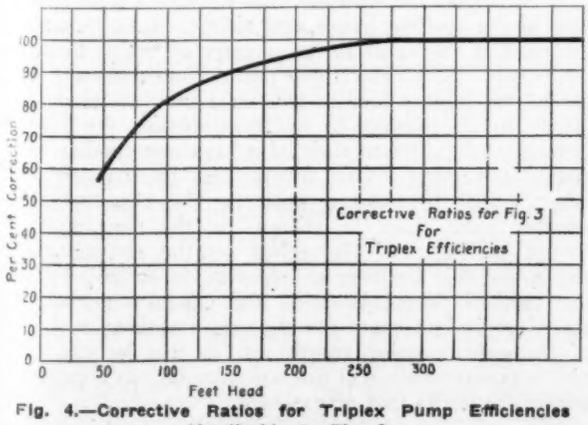


Fig. 4.—Corrective Ratios for Triplex Pump Efficiencies Applicable to Fig. 3.

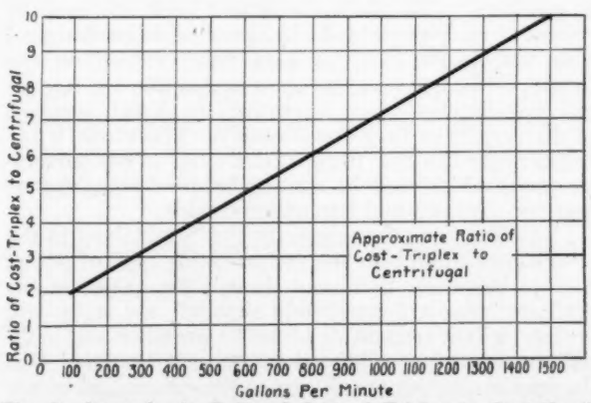


Fig. 5.—Approximate Ratio of Cost of Triplex to Centrifugal Pumps.

are usually designed for operation under a head of 200 to 230 feet in a single stage, and for the same maximum speed condition. This means that the modern design of single-stage centrifugal pumps is applicable to the usual requirements of municipal pumping plants, operating singly for domestic pressures and in series for fire pressures. In discussing centrifugal-pump sizes it is well to note that there is no definite relation between the capacity of a centrifugal pump and the size of the discharge opening, as the capacity is determined by the impeller rather than by the size of the volute casing. Many engineers do not appreciate this and purchase a pump by specifying the discharge opening rather than by naming the operating characteristics.

Operating Characteristics of Pumps.

In the above we have compared the sizes obtainable in standard machines in both the triplex and centrifugal types, preparatory to a discussion of the operating characteristics of the two pumps, and therewith the proper selection of the correct pump to be used for a given condition.

The capacity of a triplex pump is determined by the size of its plunger and stroke, combined with the speed with which it is operated. The speed is usually constant, therefore the capacity is fixed. The pressure against which the standard pump will operate is determined by the design of its cylinder and crank shafts, rather than by any operating characteristic. In other words, the pressure curve of a triplex pump becomes a straight line with the capacity remaining a constant item, and the limit of pressure being set by the manufacturer at 90 to 150 pounds for particular pump designs, and regulated by means of either a relief valve or by-pass valve.

The capacity of a centrifugal pump is dependent not only upon the size of the entrance and discharge nozzles of the impeller, and housing, but also, and to a very great extent, upon the pressures against which it may be operating. The suction conditions also may affect the capacity of a centrifugal pump to a greater extent than it would affect the capacities of a reciprocating type of pump.

Fig. 1 shows in general the characteristic curves that obtain in the operation of a centrifugal pump in its widest ranges. The capacities in gallons per minute are given as abscissas with the head, efficiency, and horsepower given as ordinates. Both abscissas and ordinates are given on the percentage basis, so as to make the curves general, the capacity, head, and horsepower being marked 100 per cent for the best point in efficiency. Naturally, to obtain high economy in operation the pump should be operated at its designed point, or at the 100 per cent point shown on the curve. This, however, becomes impossible for municipal installations when operating on direct systems, as the capacities vary considerably. Therefore, it becomes important that the characteristics of the particular pump to be used be studied before its final selection for a varied and important service.

In addition to the simplicity that is obtained in the centrifugal pump over the reciprocating type of pump, it is to be noted, that even though the valves in the discharge pipe are completely shut off, the pump will operate within reasonable limits of pressure and without the use of a relief valve. It will be noted that the maximum pressure shown on the curves and occurring at the point of no capacity, or when the discharge valve is closed, is approximately 20 per cent greater than the normal pressure against which the pump should operate. As the discharge valve is opened, or the pump is allowed to discharge water, the pressure gradually decreases to the point of normal operation. If the pump is operating under conditions which will permit of lower pressures than the normal operating pressures, it will be noted that the capacity of the pump will increase to a somewhat greater amount, this limit being determined by the design of the inlet to the impeller itself, and also fixed in a general way by the suction conditions that may obtain.

Fig. 1 gives general characteristics only. Fig. 2 shows the results of a standard volute centrifugal pump operating with a total pressure of 60 pounds or 138 feet and with a capacity of 600 gallons per minute.

Frictional resistances to flow usually form an appreciable part of the total pressure head against which the pump must operate. Engineers, and particularly those engineers who operate with reciprocating pumps, may be tempted to be very liberal in estimates of the friction head which should be added to the static head. This may perhaps be considered a conservative practice when a reciprocating pump is to be used, as the increase or decrease in actual pressure that will obtain in service has no material effect upon the other operating features of the pump. The characteristic curves in both Figs. 1 and 2 show that with a centrifugal pump the frictional resistances must be quite definitely known, else the pump may operate at an altogether different capacity than anticipated and perhaps at a lower economy and call for a greater horsepower.

It is very important, when considering the pressure head against which pumps can operate, that the suction lift of the pump be carefully considered. The total suction lift on a pump is the sum of the static lift, the velocity head, and the frictional losses in the pipe and foot valve. When operating under maximum suction conditions, if one of the above three items increases, one of the other two must decrease a similar amount, as the sum of the three items cannot be exceeded. Therefore, if the static lift increases, the velocity head, or in other words the quantity lifted, must decrease and the capacity of the pump is thereby definitely limited.

Both reciprocating and centrifugal types of pumps can operate against the same suction lift. The capacity, however, of the two types of pumps will be affected differently. In a triplex pump the maximum suction lift for full-capacity operation is dependent to a very great extent upon the friction in the suction pipe and upon the leakages that may obtain in operation in the stuffing boxes and valves. Low velocities are used at all points in the passage of water through the pump. In a centrifugal pump conditions are different, as high velocities are necessary at nearly all points in the design in order to obtain the higher economy. The effect then of a high suction lift on a centrifugal pump is to foreshorten the capacity, in other words to place a limit on the capacity at a smaller point than is shown on the characteristic curves in Fig. 1. The effect on the characteristic curves by this limiting in capacity, is shown, by the the vertical dotted lines on the capacity curve. It therefore is important for the manufacturer to know of the exact suction conditions, so that he can furnish a pump which will operate normally at a capacity within the limits that may obtain.

(To be continued)

Editorial Comment

Promoting Safety in Electrical Construction

SAFEGUARDS against hazards to life and limb are more needed now than ever. This is not only because of humanitarian considerations, which always should obtain, but more especially because the country's need for all possible man-power necessitates minimizing accidents with their attendant casualties and loss of working time. The nation cannot spare a man nor needless cost of medical and surgical attention. Evidently safe construction, safe maintenance, and safe operation are urgently required.

Electrical men are apt to forget that the use of electricity introduces hazards. This is because progress of the art has been so rapid that electrical hazards have been fairly well guarded against and the number of serious accidents from this cause is relatively low, compared with the very large number due to non-electrical causes in such industries as mining, iron and steel production, steam railroading, etc. But electrical accidents do still occur and the fact that they occur is due primarily to the negligence of the electrical industry.

Electricity is not always a safe medium to handle, nor is scarcely any other medium or thing. Gas, steam, fire, are recognized as dangerous mediums, but so even are water and air under certain conditions, as is attested by thousands of drownings annually and many fatalities from tornadoes and other wind storms. Because anything is dangerous is no reason why it may not be useful under proper safeguards. With electricity, as we have advanced with its applications, so have we fairly kept pace with its protection, which accounts for our well merited assertion that it is the safest as well as most useful general medium. The fact is that our knowledge of what is required to safeguard electricity utilization is now so perfected that electrical accidents are now entirely inexcusable.

Until recent years there may have been a little excuse for construction and operation of electrical equipment in such a way as to leave live parts not fully protected from possible contact by an innocent person. The safety requirements were not fully investigated and certainly not generally known. Recognizing this situation, the Bureau of Standards undertook an extended study of the subject, the result of which was the National Electrical Safety Code. A summary of the Code and of the first year's results of its use was given in our issue of January 5, 1918, in an article by our esteemed friend and former technical editor, Dr. M. G. Lloyd. He showed that the new Code was being favorably received by nearly all electrical interests, especially by many important utility companies, manufacturers, insurance companies, inspection departments, utility and industrial commissions, etc. With this excellent start it was to be expected that the Safety Code would soon exert an important influence in the promotion of greater electrical safety.

Inquiry among electrical contractors has shown, however, that as a whole they are woefully ignorant of the new Code. Since on them will fall the duty of putting into effect the rules of Part III of the Code, which part deals with installations in factories and other places occupied by non-electrical persons, it is evident that the contractors should soon become acquainted with at least this portion of the Code. The importance of this was pointed out in our last issue and announcement made of our intention to reproduce the rules of Part III in a series of installments in our section on Contracting-Construction, beginning with this week's issue.

Perusal of the first section of these rules published herein should not only acquaint the reader with the general scope of the rules, but also convince him of their reasonableness. They impose no drastic hardships nor requirements that are difficult to carry out. The rules can be easily applied and in most cases at no additional expense whatsoever. It is because of their reasonableness that it is to be expected to find architects and engineers including compliance with them as part of their specifications in the near future and to find inspectors insisting on their execution. This makes it all the more important that contractors become familiar with this part of the Safety Code. Since most electrical contractors are not very busy just now, this is an especially suitable time for them to study the new Code. The discussion and explanatory matter given as supplementary to the rules will be found very helpful in a clear understanding of them.

The ELECTRICAL REVIEW has, throughout its long career, steadfastly stood for the best possible electrical construction. It takes pleasure, therefore, in bringing to the attention of electrical contractors in this manner the well thought out rules of the new National Electrical Safety Code, the general application of which will go far in making the use of electricity still more safe than it now is.

Reaching the Industries Through the Press

THE Ordnance Department of the Army proposes to shortly inaugurate a publicity department, the purpose of which will be to keep the industries accurately informed of what the Government desires them to know. This publicity will be carried on

through existing channels—the lay and technical press. By explaining in proper manner matters of interest and concern, rumors will be put down, misunderstandings averted, and opposition and propaganda bred of secrecy, rumor and misinformation will be largely overcome. The idea is a good one, and comes in answer to a real need. It should go far toward allaying rumor and false alarms, will prevent apprehension and needless worry by those who have given to the country's cause, and at once tend more toward democratic ways. But more important still, this publicity carried on scientifically will create trust and co-operation, efficiency and unification of the people, strengthening the nation for the supreme purpose.

Into the scheme of things the daily papers and technical press will continue to play their part. And it will be accomplished automatically through the efficient channels that already exist, for the press will constitute the medium by which most of this publicity propaganda that aims to bind in stronger, more efficient, more friendly bonds the people and those that represent them will be carried on. Education and pride, co-operation and faith will come from this method of taking the people into the confidence of the Government.

But while the Ordnance Department promulgates an undertaking to increase the efficiency and strength of the nation, the Postal Department is preparing to harass, handicap and destroy the channels the Ordnance Department plans to use for serving the country best. What the Ordnance Department aims to do, the Postal Committees of Congress tried to undo. The publicity which the Ordnance Department aims to encourage, guide and spread throughout the country amongst laymen, professional and tradesman by the trade and technical press, the Postal Committees throttle, hinder and hamper by taxation.

To discuss the efficient co-operation of press and government for the efficient and effective distribution of knowledge, encouragement of ideas and co-ordination of effort and thought in channels where it may do most good, and to impose a tax upon technical journals that will curtail the circulation of all, is to discuss two matters directly opposed. Co-operation, so much discussed, so often implored, is not for the masses alone, for business men and manufacturer. Co-operation is the crying need among those upon whom rests the sacred responsibility of carrying on the war. If two departments in Washington, almost under the same roof, cannot co-ordinate their requirements and policies and work in harmony for efficient purpose, surely confusion, lost motion and inefficiency —needless bloodshed and loss of life and waste of national treasure—must be expected when our efforts spread far distant to other lands.

If the taxation of technical journals, the so-called second class postal zone rate, comes into force in July it will be one of the most short-sighted and far-reaching policies instituted. It will be a flaring example of frenzied legislation. Now, if ever, is there need for a country united, a nation with one purpose against a common foe, a people standing behind the President, awake to the dangers of inertia, enthusiastic for the victory of democracy, alive to the post-bellum trade that awaits a country prepared and capable. From whatever angle this proposed postal taxation is viewed, personal or impersonal, practical or academic, sentimental or callous, it is unfair and unwise. Its passage will be a fatal mistake in the interests of the nation and the people. It threatens disintegration if not destruction of one of the fabrics of a united nation. It will stifle the interchange of ideas and hamper progress where there is such need to foster, it will quench interest instead of cultivating it. The Constitution of the United States was drafted to assist the development of humanity, encourage the progress of democracy and civilization, and foster science and art. The war is being waged to make democracy safe, to assure freedom, and free others from the shackles of autocracy and serfdom.

The press must remain national, not sectional. Now, more than any other time, must the people rest secure in the knowledge that the press is free, untaxed, unharrassed for free interchange of ideas, symbolic of free thought in a free country. The public press, no less than public office, is a public trust.

Repeal this act. Encourage the dispersion of knowledge and the policies of the Government. Keep open and widen the channels through which the Government makes its policies, its hopes and actions known to the people, in the name of Democracy.

The Commercial Electric Vehicle

UNDER the merciless influences of war, transportation deficiencies and possibilities have forced consideration. The failings of the horse, its extravagance and limitations, now bode badly for the horse in our large cities and assure its diminished use in many smaller ones. Hope is now offered that congested terminals and streets and delays in delivery may be relieved by co-operative trucking and the initiation of haulage and teaming upon a sound economic basis.

Electric and gasoline truck must each play its part in solving the transportation problem now in process of evolution. How large a part is taken by the electric truck depends upon the bigness and capabilities of those sponsoring the cause of the electric and their initiative and ability to be ready for whatever comes.

Now is the time to launch a wise, carefully planned and ably prosecuted drive to place the electric truck where it ought to be in the best interests of its owners, the people, the electric vehicle manufacturers and central stations. Now, if ever, the electric vehicle should come into its own. Let everyone co-operate and go "over the top" with the electric truck.

Week's Events

American Institute Meeting in Cleveland—Minnesota Association—New York Commission Discusses Power Service

JOINT MEETING OF AMERICAN INSTITUTE AND IRON AND STEEL ELECTRICAL ENGINEERS.

Several Papers on Steel-Mill Motor Drive Presented at Cleveland Meeting.

An inter-section meeting of the American Institute of Electrical Engineers in which the Cleveland, Pittsburgh, Toledo, Detroit and Toronto Sections of the Institute participated, was held in the Electrical League Rooms of the Hotel Statler, Cleveland, Ohio, on March 8. Four papers were read, those at the afternoon session being presented to the members of the Institute only, and those at the evening session being presented to both the Institute members and the members of the Association of Iron and Steel Electrical Engineers. An informal dinner was given just before the evening session.

E. W. Rice, Jr., president of the Institute, opened the meeting with a brief address to the Institute members. Mr. Rice called attention to the fact that Cleveland was a particularly appropriate place for the meeting as it is the center of a great field of electrical industry and has a prominent place in the history of electrical development. The speaker directed particular notice to the position of Cleveland as the home of the Brush dynamo and pointed out that in this city the first "division" of the electric light was made.

Design of Underground Distributing Systems.

Mr. Rice's brief remarks were followed by the reading of the first paper, "The Design of Underground Distribution for Electric Light and Power Systems," by G. J. Newton.

Taking the process step by step, the author showed the method of designing the distribution system, such as is usually required for a medium-sized city. No two systems are exactly alike. Operating conditions and municipal requirements are different in every locality, so that it is impossible to make any definite rules that will cover all conditions.

By assuming a set of average conditions that could exist in any of the smaller cities it is possible to show the fundamental principles of handling the problems of design in a systematic manner.

The problem considered in detail in the paper was to take up step by step the design of an underground distribution system in the business section of a medium-sized city. Assumption was made that the system consisted of 110-220-volt single-phase lighting, 220-volt three-phase power and a street-lighting system, as an arrangement similar to this is frequently met with.

Costs in connection with the work were given by the author, all of these being based on normal conditions and not on present costs.

The reading of the paper was followed by a short discussion.

Capacity of Rolling-Mill Motors.

The second paper of the session, "Some Considerations in Determining the Capacity of Rolling-Mill Motors," by Robert P. Hamilton, was then read. This took up in detail a method of calculating the energy required for rolling various steel sections and calculating the relation of speed to tonnage, motor capacity and flywheel application. An abstract of the paper follows:

"Paramount in any rolling-mill electrification," says Mr. Hamilton, "is the problem of delivering a specified tonnage of steel, of which the grade and section are known, at a minimum total cost. Each case must be carefully analyzed and the most suitable equipment chosen. In general, the drives may be classified as follows:

"1. Continuous running mills: (a) constant-speed motors; (b) adjustable-speed motors.

"2. Reversing mills.

"Item 1 may include two-high or three-high mills, of nearly all types, *i. e.*, plate mills, sheet mills, cogging or blooming mills, merchant mills, rod mills, etc. By far the greater number is driven by constant-speed motors. Adjustable-speed motors are found where it is desirable to roll a variety of sections in the same mill.

"One of the most efficient drives is by means of a high-speed induction motor with ropes or gearing. If speed variation is necessary, this may be accomplished in the case of an induction motor by controlling the rotor frequency with a synchronous converter or alternating-current commutating motor. Instead of the adjustable-speed induction motor it is often found advisable to use adjustable-speed direct-current motors and synchronous converters, assuming, of course, that the supply is an alternating-current system. If the first mentioned scheme includes an auxiliary motor on the shaft of the main motor, constant power output may be obtained at the rolls throughout the range of speed. When it is necessary to increase the speed of rolling, the torque required is usually less, which condition is also met by a direct-current motor with shunt-field control. In a few special cases cascade motors or Ward-Leonard motors have been used to drive continuous mills.

"The reversing mill is best suited to the work of cogging ingots to billets. The speed of rolling is changed from pass to pass as the billet lengthens and the reversing does away with the lifting tables, which are generally necessary in a three-high mill. Electric motors which are to meet such service must be capable of withstanding large overloads, since no flywheel is interposed between the motor and mill. Ward-Leonard control is used over the range of speed in which the torque is a maximum, and shunt-field control at the top speeds when the torque is reduced. An Ilgner set supplies the energy for the motor."

The remainder of the paper treated in detail the calculation of energy required for rolling, determining

motor capacity, methods of calculating flywheel, and so on.

A discussion followed the reading of the paper.

Informal Dinner.

At the informal dinner which was held between the two sessions, the speakers touched briefly on the development of the art, and the great need for extra effort and extra work at this critical time in our history. Ambrose Swasey recalled some interesting phases of early electrical development and touched on the great importance of making science safe rather than destructive of life and property, as in the great war. His talk was followed by a few remarks from Charles F. Brush, who called attention to the important work of Americans in the development of science and particularly to the application of electricity to industry.

Selection of Steel-Mill Auxiliary Motors.

At the evening session a paper entitled "Selection of Steel-Mill Auxiliary Motors and Control as Affected by Mechanical Features of the Drive" was presented by J. D. Wright. The author discussed manipulators for blooming mills, describing in detail the side guards and lifting fingers of a number of installations. The author called attention to the fact that lifting fingers might be either reversing or non-reversing, as the circumstances demanded. Motors might be either series or compound-wound. Dynamic braking and solenoid brakes might or might not be used.

In summing up, Mr. Wright said that there must be one method of operating these devices which is superior to all others. What this method may be can be determined only from actual operating experience, and it is to the steel-mill electrical engineers that we must look for the results of such experience.

In discussion of this paper, E. Friedlaender remarked that there are many points in favor of the high-speed, mill-type motor. One of the more important considerations is that quicker delivery to the mill can be secured. Suggestion was also offered that if 100 per cent balance could be secured in the case of the tilting table there would not be any trouble with the smaller high-speed motors. Mr. Friedlaender also brought out the necessity for full reversible control on account of the fact that the operator often "inches" the table one way or the other.

Suggestion was made by C. A. Menk that smaller motors could often be used in conjunction with hydraulic devices. He also pointed out the great need for simplifying the mechanism wherever possible. H. S. Richardson and E. G. Beck also took part in the discussion of this paper.

Motor Standardization.

The report of the Standardization Committee of the Association of Iron and Steel Electrical Engineers was read by W. T. Snyder. Particular attention was called to the need for steel-mill motors that are interchangeable in some degree at least with those of other makes. As interchange of motors of different makes has not been possible, practically all steel plants are going as far in the matter as they can, and are selecting one make for each mill in order that the supply of repair parts for the mill may be kept as low as possible.

In the matter of buying motors there seem at present to be two alternatives: First, to pick out one make of motor and stick to it; second, to go into the open market and buy the cheapest motor for each job on a purely competitive basis. If the last plan is followed the result is a conglomeration of motors of all sorts, with a multiplicity of spare parts in stock all the time.

It was pointed out that there are at present about 1,000,000 small motors in the steel-mill industry. For these motors approximately 500,000 armature changes will have to be made, and about 2,000,000 complete sets of spares will be used to keep the motors in service. This means about $8,000,000 worth of spare parts. By standardization of the motors in the iron and steel industry it is estimated that this figure could be reduced to $2,000,000 and that the stock of repair parts could be reduced to 500,000 or less.

In one particular case, mentioned as an example, an installation of 400 motors, all alike, required only 28 spares, while 400 motors of assorted makes needed 116 spares. It is within reason, said the speaker, that standardization could bring about a reduction of 73 per cent in the investment tied up in spare parts.

In discussion of this paper C. A. Menk spoke of the confusion that resulted from many makes of motor in one mill. In one case cited, a variety of motors necessitated keeping in stock 54 different windings, commutators, brush-holders and other parts.

E. C. Beck, D. M. Petty, H. C. Cronk and others also shared in the discussion of the paper.

In closing the meeting, Mr. Rice stated that he was very much in favor of standardization, and was of the opinion that, if suitable standardization of some sort could be agreed upon by manufacturers without interfering with the development of motor design, the result would not only be better motors, but would probably be better prices to the mills.

BRITISH GOVERNMENT TO PROVIDE FOR WAR WORKERS.

A special investigation is being made by a committee of electrical and general engineers by order of the British Government concerning the possibility of encouraging and providing new industries connected with the engineering trades so that the immense volume of labor that is at present employed upon certain classes of war munitions manufacturing may be profitably utilized both in the interests of the workers by affording them employment and in the interests of the nation by assisting industry which can conveniently occupy the greatly increased factory accommodation made available during the last two or three years. A number of representatives of well-known electrical manufacturing firms are on the committee, of which the Hon. H. D. McLaren, M. P., is chairman.

Lists are already being compiled of articles suitable for manufacture by British engineers which are either not made in the United Kingdom at all or are not made in sufficient quantities, but for which there is likely to be a demand after the war. The lists are being classified in three groups, namely: Articles that can be made (1) by women; (2) by men and women; (3) by skilled men, and the committee will show to what industries the proposed new manufacturers should be attached. The articles range from the biggest engineering tools down to the smallest accessories.

For some time plans have been under way for bringing about gradual demobilization of the army and workers with a minimum amount of disorganization and inconvenience at the close of the war.

MINNESOTA ASSOCIATION STRESSES CONSERVATION AND CO-OPERATION.

Eleventh Annual Convention, Held in Minneapolis This Week, Proves Itself Decided Value to Members and Delegates.

Pausing long enough in their arduous and exacting duties to consider their relations to the people of Minnesota, the central stations, jobbers, dealers and contractors to the number of 400 attended the eleventh annual convention of the Minnesota Electrical Association held in Minneapolis on March 11, 12 and 13. Every Minnesota city and town of importance was represented. As a whole, they probably represented the best and strongest group of electrical executives in their respective positions that were ever brought together at one time in the Northwest, and of their unselfish devotion to the cause of the electrical industry and its relation to wartime business methods there can be no doubt.

With the idea that it is quite within the range of possibilities that the war will continue for some time to come, conservation of resources and concentration of thought were the keynotes of the convention. Only the most important and pertinent subjects were discussed.

"Every dollar must be stretched to its breaking point, every man must work intensively, if the men of Minnesota are to do their share with the splendid spirit of devotion and self sacrifice to which the policy of the Government is entitled. Even the slightest thought in any other direction is equivalent to a contribution to the cause of the Kaiser. Earnestness, steadfastness, sincerity of purpose, mental balance and calmness of judgment, and our ability to co-operate amicably with other essential industries, is just as vital and necessary back here in America as is ammunition in France," remarked President Otto in his opening address.

"We of the electrical industry," he said, "are entrusted with leadership and responsibility and we must direct the vital essentials of light, heat and power with a cool, calm, collected mind." And so it went. The spirit of the industry in Minnesota is perfectly clear.

Monday, the opening day, was devoted to registration and getting things in order generally. The order of the day seemed to be getting together, getting acquainted and renewing old acquaintances.

The exhibitors' section, always present at such a gathering, was particularly active, alive and constantly reiterating the many ways in which their particular electrical wares are assisting the Government in the propaganda of conservation. Among those exhibiting were the following: Hotpoint Division, Edison Electric Appliance Company, Duncan Electric Company, Electric Appliance Company, Peerless Electric Company, Western Electric Company, Northern Electric Company, General Electric Company, Findley Electric Company, Moloney Electric Company, St. Paul Electric Company, Sterling Electric Company, George Cutter Company, Naugle Pole & Tie Company, Julius Andrae & Sons Company and the Northwestern Electric Equipment Company.

Tuesday morning session was devoted to the president's address and the reports of the secretary-treasurer and the various committees. At noon the delegates were entertained at a luncheon by the Minneapolis Jovian League. The feature of this luncheon was a talk by Dean John R. Allen of the University of Minnesota on the subject of "Electricity in Turkey." Dean Allen spent considerable time in Turkey and handled his subject masterfully.

The big feature of the day was an address by George A. Hughes, president of the newly-formed Edison Electric Appliance Company. Mr. Hughes discussed the subject of "Electricity and Conservation," and dealt with the part electricity, through the medium of electrical appliances, will play in the conservation of coal, labor and food, and how it is assisting in the conservation program of the Government.

S. B. Hood, superintendent of distribution of the Minneapolis General Electric Company, spoke on "The Proper Grouping of Transformers," dwelling on the importance of grounding secondary neutrals and the necessity of preparing accurate single-line circuit diagrams before laying out an interconnected system. Mr. Hood has the reputation of being one of the pioneers in distribution systems, having a large following not only in this country but also in Canada. His paper contains valuable diagrams and a veritable fund of useful data for the man interested in distribution problems.

Immediately following Mr. Hood's paper at 4 p. m. the delegates and members proceeded to the new Mazda lamp factory of the National Lamp Works, in Minneapolis, where they were shown through the works, following which a banquet was served, at which the National Lamp Works and the Northwestern Electric Equipment Company joined as hosts.

The final feature of the day included a special entertainment in the way of a theater party arranged through the courtesy of the Twin City jobbers and manufacturers.

The program for Wednesday included a paper by George Hewitt, assistant superintendent of the meter department of the Minneapolis General Electric Company, upon "Maintenance of Electric Meters," and a paper by Prof. W. T. Ryan, of the University of Minnesota, on "Iron Wire Tranmission Lines." Professor Ryan's paper discussed the relative advantages, from the standpoint of economy, of iron and copper wires. He stated that as the price of copper has now risen to such a high point, the economical advantages of iron wires for short, high-voltage lines are receiving more careful consideration. As a result of war prices for copper, operating companies must consider the use of iron wires for transmission and distribution, he declares. Not only must distribution and transmission men consider the use of iron wire in war times, but consideration of its use in normal times Professor Ryan declares to be good business and in the interests of economy.

The final paper of the day was by R. D. Thomas, superintendent of the St. Anthony Falls Water Power Company. This paper dealt with "Minnesota Water Powers," and discussed a comparison between western water powers with high heads and constant streams and Minnesota water powers with low heads, large volumes of water and varied stream flows.

North Coast Power Cuts Rates.—The North Coast Power Company, which serves Chehalis, Wash., announces that the State Public Service Commission has agreed to the tariff which the company recently filed with the commission, providing for a cut in the electric rates in that city. The cut amounts to about 33⅓ per cent, becoming effective February 1. The new rates are 9 cents for the first 40 kilowatt-hours and 5 cents for all over that amount. The former rate was 12 cents for the first 20 kilowatt-hours.

CENTRAL STATION VERSUS PRIVATE PLANT DISCUSSED AT COMMISSION HEARING.

Continuation of Hearing Before the Public Service Commission of New York to Ascertain Facts Relative to Possible Coal Saving.

As mentioned in last week's issue, the investigation instituted by the Public Service Commission of New York, First District, is to ascertain what, if any, coal saving might be made by the substitution of central-station service for private plants in various classes of buildings and industries. It is expected that the information thus brought out will be of assistance to the United States Fuel Administration, whose representatives are in attendance at the hearings.

As might be expected, the private-plant owners assume that the results of such an investigation may be one of the factors which may possibly bring from the Fuel Administration an order for them to suspend operation and accept central-station service. Therefore quite a number of private-plant owners were present at the second session of this hearing on March 4, prepared to present their side of the question.

The first witness on the stand was J. W. Lieb, vice-president of the New York Edison Company. Mr. Lieb had been instructed to bring data to this meeting to establish the amount of coal which might be saved if the 650 odd private plants in the city of New York were shut down and central-station service substituted.

From data which he had collected, he was able to make the statement that from 500,000 to 830,000 tons could be saved per year—a very conservative estimate being the lower figure.

Another question asked previously had been for him to cite specific instances of saving. This he did with the data before him. It brought out some interesting figures.

Case No. 1. An 11-story office and loft building plant had been closed down in the early part of 1917. Data were collected for a period of 10 months and compared with the corresponding 10 months of the previous year under private-plant conditions. The private plant had consumed 1316 tons. Under central-station service for light and power there had been 541 tons consumed at the building for heating and similar purposes, and 159 tons at the central station to generate the electrical power delivered—or a total of 700 tons. This represented a saving of 616 tons or 47 per cent.

Case No. 2. A 5-story and basement building. One year of private-plant operation consumed 7237 tons. With central-station service—2927 tons for steam heating on the premises, 1403 tons for Edison energy supplied; total 4330 tons. Saving 2907 tons; 40 per cent.

Case No. 3. Apartment house. The annual coal consumption, average of 3 years, was 2107 tons. With central-station service, the annual coal consumption for steam heating (average of 2 years) was 1113 tons; for producing electrical energy supplied, 193 tons; total 1306 tons. Saving 801 tons; 26.3 per cent.

Case No. 4. An 8-story apartment. Annual coal with private plants, 750 tons. With Edison service, 240 tons on the premises, 178 tons at the central station. Saving 332 tons; 44.5 per cent.

Case No. 5. An apartment building. Annual coal consumption with private plant, 6200 tons. With Edison service, 5212 tons on the premises and at the central station. Saving 988 tons; 15.9 per cent.

W. W. Wells, of the Brooklyn Edison Company, was next called. The Borough of Brooklyn differs in the class of service required from that of Manhattan, in which latter the private plants are mostly in office buildings, hotels and apartments.

Mr. Wells classified the uses of coal in his borough under four general groups:

(1) For electric lighting.

(2) For mechanical energy (shafting, etc.) which is typical of the Brooklyn load.

(3) For manufacturing processes requiring high temperatures by live steam.

(4) Heating during winter months.

Private plants in this borough are used for three general classes of service:

(1) Steam for heating, with electricity for light and power. These are easy to supply from the central station with scarcely any additional cost for equipment.

(2) Heating, with electricity for light and mechanical power. These are also readily converted to central-station service but with varying cost for equipment—not radically high, however.

(3) Large quantity of steam for manufacturing processes with relatively small amount for electric light and power. Economy of converting to central-station service doubtful and at best expensive.

There are approximately 570 private plants in operation in Brooklyn burning coal. They range from 25 horsepower to 5000 horsepower and consume 150 to 100,000 tons of coal per year each.

Among those coming in class No. 1 of the latter group there are about 25, consuming approximately 175,000 tons a year. Taking out two doubtful ones, there are 23 left, consuming 80,000 to 90,000 tons of coal a year which could be converted with little or no cost to central-station operation, saving thereby 25,000 tons of coal a year.

There are also about 25 plants that come under class No. 2, which use 60,000 tons a year, and if converted (at moderate cost) would require approximately 25,000 tons less.

The remaining private plants consume 750,000 tons a year and a saving might be made by central-station operation of approximately 100,000 tons a year. But the expense of conversion and the peculiarities of the service would be so great as to make such steps inadvisable.

Testimony of Private-Plant Operators.

The private-plant interests then had their "inning." Walter J. Salmon, representing a leasing company with an important up-town property, said that this property contained a Turkish bath. His patriotism was as sound as that of any one. Also his Turkish baths filled certain patriotic requirements, for they cleaned many soldiers each day. He figured that his lighting current cost 2 cents per kilowatt-hour. Current is also furnished to premises adjoining. It was felt that if they were compelled to change to central-station service for the latter and their steam plant utilized only for the baths and heating that it would be unprofitable.

Mr. Strauss, a representative of one of the large department stores, said that they were always ready to be shown, but that the Edison company in furnishing estimates on cost of operation invariably based them upon too low a kilowatt-hour consumption. They also have elevator problems and low-pressure steam

problems to contend with, embodying present plant and amortization problems that never had been successfully met on estimates. He also had grave doubts as to the accuracy of the central-station company's meters. So he was still unconvinced that any real saving could be made.

Mr. Patterson, a consulting engineer, had made a comparative study of private plant and Edison service in a Fifth Avenue building. The figures he submitted to the Commission as an exhibit in the evidence. In general, he said these were very much in favor of the private plant although in the matter of actual coal consumption very slightly in favor.

C. J. Campbell, attorney for the Hotel Owners' Association of New York City, introduced as witnesses Thomas F. Ballad, chief engineer of the Hotel Belmont, Mr. Townsend, managing director of the Hotel Majestic, and Mr. Trowbridge of the St. George Hotel, Brooklyn.

The point was brought out, however, that the hotel private plant is of a class peculiar to itself on account of the varied uses made of steam aside from the development of light and power. That, moreover, only 10 per cent of the heating value of the steam is consumed in the engines with 90 per cent available for these other uses.

CLASSIFICATION OF DEMAND PERCENTAGES.

By R. S. Hale.

In regard to Chester I. Hall's very interesting article on the classification of demand percentages and to the figures he gives as to the relative percentage of 5, 15, 30 and 60-minute demands, in the Electrical Review of February 23, it would appear as though these ratios were fairly uniform; and undoubtedly they are uniform for the ordinary factory, whether it be for light or for heavy manufacturing, for automobile work or for wood working. The figures would, however, be very different in some of the other cases.

For instance, in the case of a small suburban railway the 5-minute demand would be a very much higher percentage than the 30-minute, and the 60-minute demand a much lower percentage.

Vice versa, in the case of a refrigerating plant the 5 and 60-minute demands would be substantially the same, unless the 5-minute demand was caused by the starting load.

It is not always appreciated that the result depends largely on the load-factor; but it can easily be seen that if the load-factor is 100 per cent, then the 5-minute and the 60-minute demands will be exactly the same as even a 5-hour demand, or the average load.

As the load-factor decreases the short demands become a higher percentage of the long demands.

CENTRAL STATIONS PURCHASE COAL MINES.

The Union Electric Light & Power Company of St. Louis, Mo., has purchased 4200 acres of coal land near Duquoin, Ill., and has sunk a main shaft and air shaft and has reached coal in both at a depth of about 225 feet. The mine is expected to have a possible daily output of 5500 tons. It will be operated by electricity obtained from the Central Illinois Public Service Company. From 1200 to 1500 men will be employed. The mine will be operated under the name of the Union Colliery Company, but all of the stock is owned by the Union Electric Light & Power Company, according to officials of the latter. The original capitalization was $100,000, but has since been increased to $250,000. It is expected that about $800,000 will be spent on the enterprise.

The Public Service Company of Northern Illinois last summer acquired coal mines in Williamson County, Illinois, and Sullivan County, Indiana, by which it is assured a continuous supply of steam coal and at lessened cost. Poor grade of coal, variable quality, uncertain deliveries due to labor troubles at the mine or trouble in transit, and high prices have resulted in many central-station companies during the last year or so purchasing mines or interests in them for their own use.

UNIVERSITY OF ILLINOIS OFFERS WAR COURSES.

A war course in radiotelegraphy is being offered by the electrical engineering department of the University of Illinois to junior and senior students of this department as an elective. An oath of secrecy and appearance before a notary public by those entering the course, vowing that they will in no way divulge any facts learned in the course to any persons other than Government officials, is required. Apparatus for receiving messages (the receiving sets alone being furnished), with confidential information and instructions for their use has been loaned the University by the United States Signal Corps. Prof. Ellery B. Paine, head of the department of electrical engineering, is the instructor in the course.

The department of geology is also offering an interesting course, dealing with the iron and coal factors in the warring nations of Europe, lines of communication and other topics concerning the geography and geology of the war theater. The University has pledged itself to instruct 5000 soldiers, either engineers or regular soldiers, for skilled war service in the departments of mechanical and electrical engineering, including laboratory and shop practice. Announcement has also been made that the ground school of the work in military aeronautics will be doubled in size, providing accommodations for 1200 students.

COLLEGE-TRAINED ENGINEERS WANTED AS ARMY OFFICERS.

The Engineering Bureau of the office of the Chief of Ordnance of the War Department desires to obtain a number of technical graduates who, if accepted, are to be given commissions in the United States Army. Highly skilled chemical and mechanical engineers capable of engaging in research work, in the preparation of chemical compounds, and in the designing of intricate mechanical devices, are needed. These men must be at least 25 years of age, must be graduates of universities or technical schools, must have an earning capacity of at least $1700 a year, must be physically sound, and must be in some other classification than 1-A under the Selective Service Law. Notification has been received in Chicago that a board of army officers will probably soon visit this city for the purpose of getting in touch with prospective candidates for these commissions. The work to be done promises to be very interesting to the kind of men qualified to undertake it. For preliminary interview, apply to the Military Training Camps Association, 624 Consumers Building, Chicago.

Commercial

Electricity in the Manufacture of Corks—Effective Vacuum-Cleaner Window—Appliances Conserve Fuel and Labor

RESTORING OLD CARS TO THE PRODUCTIVE CLASS.

An old electric vehicle that is stored away in an obscure corner of the garage may represent certain value to the owner, but it naturally does not exist at all as far as the central station is concerned. Says a central-station sales manager: "We have recently undertaken the task of getting all old, unused cars in our territory back at work on the lines and have been successful to a considerable degree. We volunteer to sell these cars for the owners, refitting them and in every way making them attractive propositions for prospective buyers. We have actually sold six cars in this fashion, each of which is now consuming not less than $60 worth of current on the company's lines. We also find a growing demand for such service in Colorado Springs, and suggest that other central stations try out our plan."

BONE-GRINDING MOTORS FOR GROCER AND BUTCHER.

Salesmen of small motor-driven grinding machines have many arguments at their command with which to interest grocery stores and meat markets in these most valuable appliances; but there is one argument that we are finding of great help which is perhaps overlooked in many instances—the use of a motor-driven grinder for grinding bones to be used as chicken feed. In the suburban districts, where many families keep chickens, almost any store can make the revenue from ground bone pay for the machine in a surprisingly short time. In Denver the grocerymen are getting 5 cents a pound and up for all the ground bone their meat markets can produce. Their meat and coffee grinders with the bone-grinding attachments are not only revenue producers, but are a boon to their poultry-raising customers.

AN EMERGENCY HELP FOR WAR TIMES.

A central-station sales manager reports the following:

"I find that it is well worth while to keep posted on any of our customers and prospects who are harassed by rush work.

"Recently I have been talking to a cabinet worker and found that he was over-worked and worried by a piece of fine cabinet making that had to be completed within a given time. One of the problems was his inability to rush the drying of successive coats of paint. I suggested the use of electric fans, and we found that it was possible to cut the paint-drying time in half. It saved him two days out of the week, and several fans are now running day and night in his shop as a result.

"It is not hard to learn of such cases as salesmen go about, and occasionally it pays well."

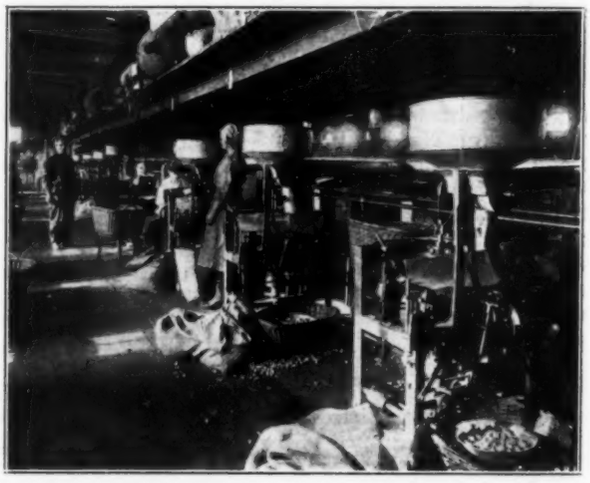
ELECTRICITY IN THE MANUFACTURE OF CORKS.

Descriptions of Processes Involved and Characteristics of Motors for Driving Machines.

WILLIAM H. EASTON.

One of the older industries that is being modernized by the use of automatic machinery and electric drive is the manufacture of bottle corks. The following description of the motor-equipment of an up-to-date cork factory may prove of assistance in planning the drive for other plants.

The raw cork is received from Portugal in the form of flat blocks which vary from ½ to 2½ inches in thickness. The first step is to cut these blocks into



Punching Cork Cylinders From Strips. Five Automatic Duplex Cork Machines Each Driven by Alternating-Current Motors.

strips from which the corks are to be punched. This is done by means of circular saws driven automatically by one-horsepower single-phase motors of 1725 revolutions per minute belted to the saws. The width of the strip into which the block is cut determines the length of the finished cork and each saw has an adjustable guide, so that strips of any desired width can be produced.

The next step is to punch the corks from the strips. In the older type of machines this is done by means of a rapidly revolving cylindrical knife, which is feathered to its shaft and can be moved sidewise by means of a lever operated by a pedal. The operator holds the cork strip against a rest and by pressing the pedal with his foot punches out a cork. He then moves the strip forward and punches out the next one. These machines are generally arranged in a long line and are group driven.

An improved form of cork-punching machine, which requires no special skill, is shown in one of the accompanying illustrations. This machine is similar

Cork-tapering Machines, Driven in a Group by Alternating-Current Induction Motor.

Close-up View of Tapering Machines Driven by Individual Motors.

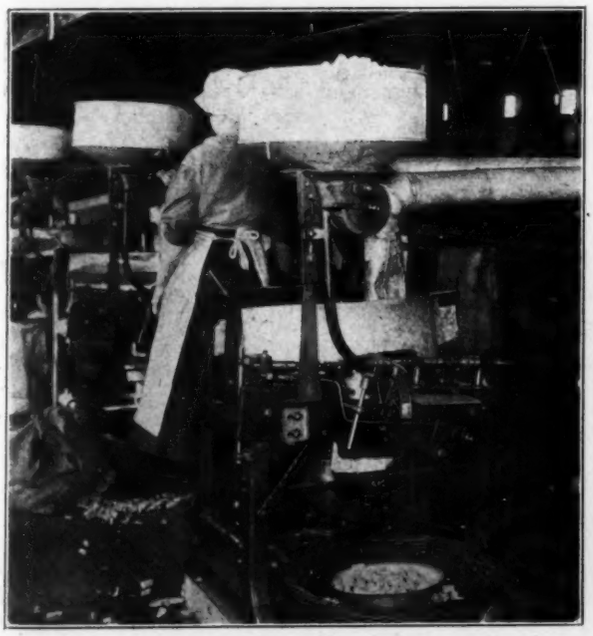
in principle to the older type, but the operator merely feeds the strips into it, and the machine itself performs all the other operations. Each machine has two punches, each with its own motor, and handles two strips at the same time. The motors shown are three-quarters horsepower of Westinghouse make.

The corks produced by these punches are cylinders, and, while a large number are used in this form, tapering is ordinarily necessary. The tapering is done in a machine, with a disk-shaped knife which revolves in a horizontal plane. The cork cylinders are fed into a hopper at the top and work down in single file through a pipe which leads them to a mechanism that seizes one cork at a time and places it between two revolving spindles that hold it against the knife. A thin shaving is cut off, which is carried away by an exhaust system, and the finished cork is dropped into a basket. The mechanism that handles the cork can be adjusted through an angle, so that any desired degree of taper can be obtained.

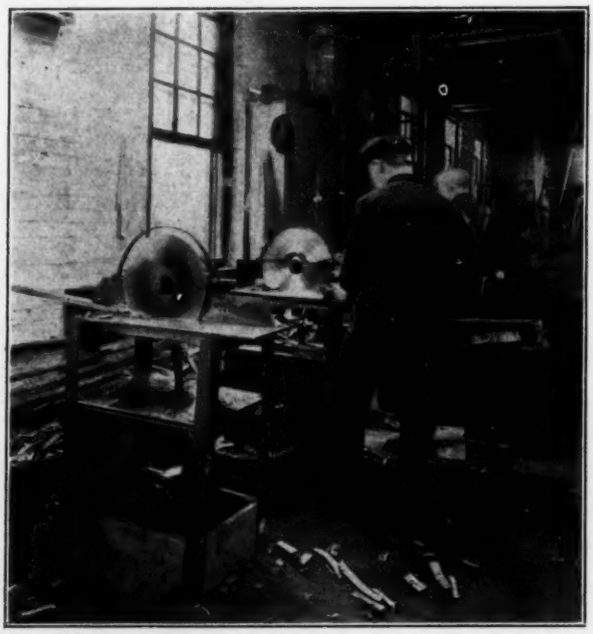
The group shown in one of the illustrations consists of 10 tapering machines and a knife grinder and is driven, together with a blower, by means of a Westinghouse squirrel-sage induction motor. A 5-horsepower motor is sufficient for this group of machines.

The corks now have to be sorted into various grades. The first grade consists of corks that are almost free from imperfections, while the last grade is very coarse and full of small holes and woody ducts. This work is done by hand, no machine having as yet been invented to perform it.

New Jersey Assembly Creates Two New Utility Board Commissioners.—By a vote of 41 to 15, the House of Assembly, Trenton, N. J., passed the bill introduced by Senator Pilgrim (Senate 44) providing for two additional members of the Board of Public Utility Commissioners. The bill was objected to by the minority as tending to create unnecessary positions.



Close-up View of Automatic Cork Machines Driven by Individual Motors.



Cutting Cork Into Strips. Four Circular Saws Each Driven by a One-Horsepower Single-Phase Motor.

AN EFFECTIVE VACUUM CLEANER WINDOW DISPLAY.

The window display of electrical appliances is an effective way of appealing to many home people at times when they have a little leisure for observation and thought. This method is alike adaptable to stores in large cities, small cities and towns, where tastefully trimmed windows receive good attention during evenings after the busy hours of the day are over, and on Saturday afternoons when there is a brief time for sight-seeing, investigating and trading. As men, women and children are impressed by pictures, so are they interested and informed by displays of utilities they would like to have, and by demonstrations. In all this, the power of suggestion is active and potent. If, by the aid of these window attractions, the observer is induced to go inside his further interest should be held by interior displays. But such attractions are merely the means of affording the salesman his opportunity.

As in the past, we present in this issue of ELECTRICAL REVIEW the illustrations of a number of window displays, which show a wide variation in the arrangement of appliances to produce a good effect. In fact, this feature offers almost unlimited scope for the genius of artistic and fetching design, to suit the requirements of the season and the appliances on which a drive is being made.

One of the illustrations shows one of the window displays in the Electric Shop of Commonwealth Edison Company, Chicago. This display is made up of two Federal vacuum cleaners and a variety of lamps

Window Display with Vacuum Cleaner as Main Feature.

and other articles which may be redeemed with Federal dividend coupons.

As will be seen from the illustration, the window is of an odd shape and does not lend itself readily to the usual form of dress. The striking feature of the present display is the frame, with black background, in which is set a vacuum cleaner. Illumination is from concealed sources above and the effect is a very pleasing one.

ELECTRIFICATION OF THE HOME AS A PATRIOTIC MEASURE.

Conservation of Fuel, Labor, Food and Transportation Accomplished by Use of Appliances.

The huge waste in the transportation of coal as compared with the transportation of electrical energy; the waste in the use of coal and the waste of labor for operations that could best be done electrically were points brought to the attention of Minnesota central-station operators by George A. Hughes, president of the Edison Electric Appliance Company, of Chicago, on March 12.

After referring to the many domestic electrical appliances available to lighten the labor of the home, Mr. Hughes said: "Home efficiency of this kind is all the more necessary in these war times. That woman is playing a vast part in our present national efficiency is conceded by all. The earning power of her family may have gone into the army, and she may have been forced into industry. There are scores of demands on her services for Red Cross and other relief work. The care of the children is an extra burden at this time when war has caused juvenile delinquency to increase. Home hygiene is no longer a mere phrase to her. We must keep our homes in good health if we are to survive. She must know how to save and yet how to keep her family nourished. She must know how to buy. She must know how to go to the polls and vote.

"In other words, the woman of today who would keep abreast of the times must be a highly efficient, highly trained brain and character.

"I attribute much of this superiority of the modern woman to those helps in the home that have released her from hours of drudging hard labor. But even at that, the women are still far behind the men in the proper use of mechanical appliances as aids in their work. The home is coming into its own as an example of efficiency and conservation, but there are still vast numbers of our homes yet to be influenced. The Society for Electrical Development says that far less than 10 per cent of the homes of the country are wired for complete electric service.

"In your campaign for the use of more electricity in the home, bear in mind, therefore, that electricity saves fuel, it saves transportation, it saves food, it saves the labor of carrying coal to a coal stove and cleaning up afterwards. It saves much of the housecleaning that coal smoke makes necessary. It does away with coal fumes. It banishes the discomfort of working in a hot room and over a hot stove. It has heat, light or power ready for instant use in any room of the house. It supplies power which relieves the housewife of much hard labor and opens to her new opportunities for having her home more sanitary, comfortable and efficient.

"In short, in these years of stress and driving industry, with everyone called on to do his utmost as well as to stop the leakage of waste, one of the best synonyms for conservation in the home is electricity."

Washington Water Power Company Valuation.—At the hearing to ascertain the valuation of the Washington Water Power Company, of Spokane, Wash., before the joint hearing held by the Washington and Idaho Public Service Commissions, engineers testified that the reproduction of the $18,000,000 light and power system of the Washington Water Power Company would cost about 50 per cent more now than when it was constructed.

Operating

Waterproofing Cement Pole Setting — Rural Line Construction — Compressed Air for Central-Station Work

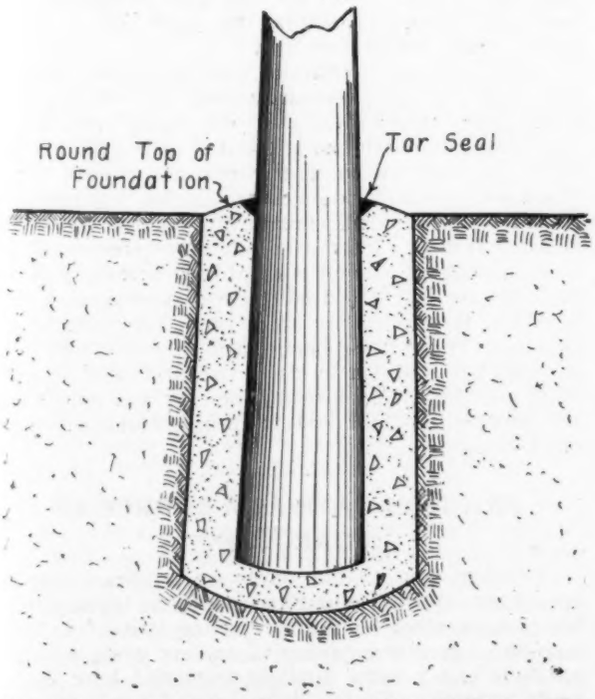
WATERPROOFING CEMENT POLE SETTINGS.

Use of Tar Seal Around Cement Set Poles Tends to Reduce Decay.

By M. Rogers.

The cement foundation has often been used either alone or with re-enforcing to increase the strength of poles decayed at their base, to make firmer poles set in unsuitable soil, and to increase the life of poles.

Moisture and fungi are the two prolific causes of decay and shortened pole life, although in cities mechanical injuries add their quota to the curtailment of useful life. Cementing the bases of poles has often been done to reduce the moisture in proximity to and in actual contact with the base of the pole. Cementing is not a panacea, however. In some cases decay has been allayed; in other instances the cement appears to have had no effect at all, whilst in others it appears as if decay had been accelerated. The probable reason is not that cement is impervious to moisture, because, relatively speaking, it is. But while moisture cannot readily enter the cement from the water-soaked earth, and thus seep through to the pole in sufficient quantity to do much damage, there is usually nothing to prevent rain and drainage down the pole from seeping in between pole surface and cement bond. The bond between the two normally can never be made water-tight.



Tar Seal for Poles Set in Cement by Which Moisture is Excluded from Seeping in Between Pole and Cement.

When a pole cracks, and any pole will crack in course of time under the influence of temperature changes of the atmosphere, drying out of the wood and other reasons, moisture or water is apt to trickle down the pole in these cracks and find its way readily into the voids between wood and cement. Here it is harbored, since the cement is sufficiently impervious to water to prevent its escape, and rot starts. This is very probably the explanation why some poles set in cement in soils that act as filters to permit ready escape of surface water rot faster than those set directly in bad soils.

Where cement foundations are used, as is often necessary where the soil is sandy, where the loading is severe or pulls are diagonally across from normal pull of the line, the entrainment of moisture in ways already described may be very largely prevented in a simple manner. This can be done by pouring hot tar around the surface of the pole at the top of cement foundation at contact of the two. When the cement is poured and before it has set, a ring or groove about 1 inch in depth should be tooled around the pole. This grove should then be filled with hot tar, as shown in the sketch. On cooling, this tar sets and makes an air-tight and moisture-proof seal through which moisture cannot enter. In course of time the pole, as all poles do, will crack. To prevent moisture seeping in an inspection should be made periodically; it may be included in patrol work, and the tar seal re-poured so as to fill up all voids and keep closed the bond between pole and cement foundation. Doing so will add very much to the life of poles set in cement.

INTERESTING MOUNTING OF APPARATUS FOR RURAL LINES.

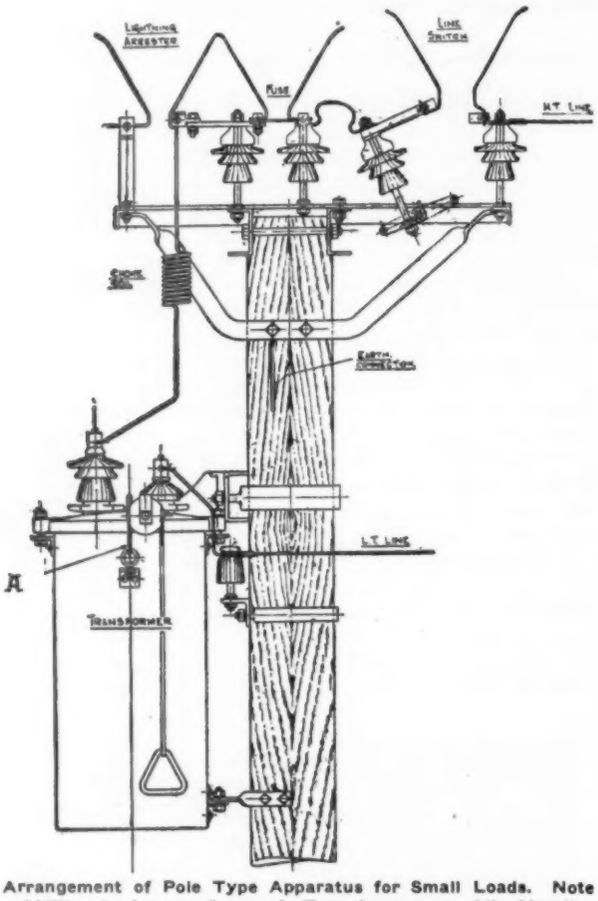
Channel Iron Construction of Pole Top Units, Isolation of Low from High Voltage and Method for Removing Transformer and Oil Switch Cases.

It is well recognized that if farms are to be electrified, if farmers' and rural lines are to be widely scattered throughout the agricultural districts where loads are at first comparatively light, line construction costs must be kept down if such development is not to progress under severe handicap. Low cost and rugged reliable construction do not usually go together, although judicious design brings them nearer than is often thought to be the case. However, reliability and simplicity do go together, as do also simplicity and low cost.

While initial cost should be kept down, so also should cost of maintenance and labor. The work of linemen should be simplified as much as possible and likewise made as safe as feasible, at the same time

choice and arrangement of apparatus being such that trouble may be located and remedied rapidly and cheaply, preferably without interfering with continuity of power supply.

The outdoor substation is one method that has



Arrangement of Pole Type Apparatus for Small Loads. Note Ability to Lower Case of Transformer or Oil Circuit Breaker by Use of Pulley and Cable. Note Also Simplicity of Pole Top Unit and Method of Mounting.

come into vogue for cutting initial costs. However, there are many instances where the load picked up does not justify an outdoor substation. It may be that a pole type transformer is needed, perhaps a fuse or circuit breaker for a branch circuit, or a remote controlled oil circuit breaker far-removed from the actual load. The sketch shows an arrangement of pole type apparatus that possesses several interesting features, one of which is that it is representative of European methods rather than American. The installation consists of transformer, line switch, fuse and choke coil. Angle iron replaces wooden cross arms. The transformer case is in two parts, much like the ordinary oil switch. The transformer coils are hung from the upper section of this case, as is also the lower half of the case, as can be seen. The bottom portion of the case is also bolted at its base to the pole, but this is to steady the unit rather than to carry weight. The upper portion of the case, which carries almost the entire weight of the transformer, has two pulleys mounted upon it. Two cables or ropes pass through these pulleys, passing to the lower section of the case. (See A.) To open the transformer case—or oil switch when one is used—to examine condition of oil, coils or contacts, all that need be done is to loosen the nuts, pull out the lugs, and slowly let the case down by feeding out the cable. The case may be let down only sufficiently to allow repairs or inspection to be made.

With this arrangement the work of renewing oil, cleaning contacts and examining transformer coils can be reduced to a minimum of time and effort. There is little danger attached to the job as all low voltage conductors are well below those at high voltage and no chance of breaking insulators or bushings. Work can be carried on quickly, cheaply and safely. The method of mounting the apparatus at top of pole as a unit which is simply bolted to the wooden pole, has also interesting features. The installation is thought to possess a number of suggestions for installations for 33,000-volt service and below.

ECONOMY OF COMPRESSED AIR FOR CENTRAL-STATION CONSTRUCTION.

Pneumatic Tools May Often Prove Useful for Station and Outside Construction, Saving Time and Money.

For many applications pneumatic tools will now be found most economical in various forms of construction, for replacing manual labor and where costs and time have to be reduced. This applies equally to work indoors as well as outdoors.

Indoors, there are often concrete walls and floors, iron slabs, steel girders and re-enforcing to be cut through in running conduit, and so on, where considerable heavy labor is often required. The pneumatic drill and hammer for work of this kind will save time, and also money, So, too, outdoors, for cutting out sections of asphalt, opening up concrete sections of the road and cement slabs on the sidewalks, the compressed air drill may be used to advantage. It is particularly beneficial in cases where an important section of road has to be opened up during the night and be relaid before traffic begins next day.

Street railway companies and municipal contractors have employed pneumatic tools for various purposes quite largely. On the other hand, central station companies have not adopted it as largely as they might for their station construction and outside work. However, recently one central station company in Iowa used an air drill when laying conduit with very pleasing results. Instead of having to remove whole slabs of cement sidewalk, as had been necessary in the past, the air drill was used to cut a strip about a foot in width, thereby saving much time and reducing the expense. When using hand cutting the cost had been 40 cents per foot, but by using two drills and an electrical portable air compressor the cost was reduced to 18 cents per foot, the job also being prosecuted much more rapidly.

FRICTION TAPE AS A SOURCE OF CORROSION.

Friction tape should never be wrapped directly upon bare copper, without an underlying layer of rubber or some other form of protecting fabric. Friction tape has a greater tendency to dry out when wrapped on itself and a fairly air-tight and solid joint is difficult to make. Such a joint instead tends to work loose and has low insulating properties. However, more important still, most friction tapes contain chemicals such as sulphur which when in direct contact with copper will attack it chemically, causing corrosion. This weakens the insulating covering and will reduce the copper cross section, and thereby reduce the conductivity and mechanical strength of the conductor.

Contracting-Construction

Section 30 of Part III, National Electrical Safety Code and Discussion Thereof—Wiring Kinks—Among Contractors

PART III OF THE NATIONAL ELECTRICAL SAFETY CODE.

Rules for the Installation and Maintenance of Electrical Utilization Equipment.

[*As announced in the issue of last week, the* ELECTRICAL REVIEW *has found electrical contractors to be extremely unfamiliar with the National Electrical Safety Code, drafted by the Bureau of Standards, Washington, D. C. This new Code aims to minimize the life hazards connected with the use of electricity. Part III of the Code is of special interest to contractors, who will be called on more and more to conform their installation work to its requirements. To acquaint them with this portion of the Code, the first section of Part III is reproduced below, followed by a discussion of its rules. The remaining sections of Part III will appear in the following issues.*]

SECTION 30.—PROTECTIVE ARRANGEMENTS.

300. Scope of the Rules.

(*a*) The following rules apply to electrical utilization equipment between 25 volts and 750 volts, where accessible to other than qualified electrical operators, as in mills, factories, mercantile establishments, hotels, theaters and other public buildings, cars and other vehicles, dwellings and similar places. Signal equipment connected to signal lines (see definition* 4) is exempted, except from rules under Section 39.

(*b*) Equipment and conductors exceeding 750 volts, in addition to complying with the rules for stations and such of the following rules as apply, shall, where accessible to other than qualified electrical operators, have all ungrounded current-carrying parts either incased in permanently grounded metal cases or conduits, or otherwise suitably guarded to prevent access or too close approach to such current-carrying parts by any but specially authorized persons.

(*c*) Electrical utilization equipment, however, as well as generating equipment, if inclosed in a separate room which is inaccessible to unauthorized persons, and when in service is under the control of a qualified electrical operator whose attention is not distracted by other processes, shall be installed in conformity with the rules applying to electric supply stations (Part I) and does not come under these rules.

301. Application of the Rules.

(*a*) The rules are intended to apply to all such installations except as modified or waived by the proper administrative authority or its authorized agents. They are intended to be so modified or waived in particular cases wherever any rules are shown to involve expense not justified by the protection secured or for any other reason to be impracticable; or wherever it is shown that equivalent or safer construction can be more readily provided in other ways.

Other methods of construction and installation than those specified in the rules may be made as experiments to obtain information, if done where supervision can be given by the proper administrative authority.

(*b*) The intent of the rules will be realized (1) by applying the rules in full to all new installations, reconstructions and extensions, except where any rule is shown to be impracticable for special reasons, or where the advantage of uniformity with existing construction is greater than the advantage of construction in compliance with the rules; (2) by placing guards on existing installations or otherwise bringing them into compliance with the rules, except where the expense involved is not justifiable.

The time allowed for bringing existing installations into compliance with the rules will be determined by the proper administrative authority.

(*c*) It will sometimes be necessary to modify or waive certain of the rules in cases of temporary installations or installations which are shortly to be discarded or reconstructed.

(*d*) In cases of emergency, or pending decision of the administrator, the person responsible for the installation may decide as to modifications or waiver of any rule, subject to review by proper authority.

302. General Requirements.

(*a*) All electrical utilization equipment shall be of such construction and so installed and maintained as to reduce the life hazard as far as practicable.

(*b*) Compliance with the requirements of the National Electrical (Fire) Code for the installation of wirings and fittings is recommended.

(*c*) Where materials or devices are available which have been subjected to examination by some properly qualified body and found to comply with the general requirements of the National Electrical Safety Code, the National Electrical Code and other nonconflicting accepted standards which apply for any given purpose, such materials or devices should be used in preference to others which have not been so examined regarding their suitability for the given purpose.

In order to avoid the necessity for repetition of such examinations by different examiners, frequently with inadequate facilities for such work, and to avoid the confusion which would result from conflicting reports as to the suitability of devices examined for a given purpose, it is necessary that such examinations should be made under standard conditions, and the record made generally available through promulgation by organizations properly equipped and qualified for experimental testing, inspections of the run of goods at factories and service value determinations through field inspections, and whose findings are subject to appeal to the Bureau of Standards.

303. Inspections and Repairs.

(*a*) Electrical utilization equipment shall comply with these safety rules when placed in service, and shall thereafter be periodically inspected, and, when necessary, cleaned. Defective equipment shall be put in good order or permanently disconnected. Defective wiring, where hazardous, shall be repaired or removed.

(*b*) Repairs, extensions and changes should be made to existing utilization equipment and conductors only by properly qualified persons.

*Signal lines mean lines for public or private signal or communication service and devoted exclusively to the transmission of signals or intelligence, . . . and the transmitted power of which does not exceed 150 watts. . . .

304. Grounding.

(*a*) *Grounding Method.*—All lightning-arrester grounding and all grounding of circuits, equipment or wire runways, which is intended to be a permanent and effective measure, shall be made in accordance with the methods specified in Section 9.*

(*b*) *Circuits Required to Be Grounded.*—All circuits installed in rooms to which other than properly qualified electrical workmen have access, or in rooms where non-electrical processes are liable to distract the attention of the electrical operator from the purely electrical operations, shall be permanently grounded in accordance with the rules of Section 9, Methods for Protective Grounding, except that the following circuits are not required to be grounded:

(1) Circuits on two-wire direct-current systems.

(2) Circuits entirely unexposed to leakage or induction from higher voltage circuits, either through overhead construction or through transformers or other devices.

It is recommended, however, that all three-wire (not delta three-phase) circuits, even if unexposed, have their neutrals grounded; and that multiphase circuits, even if unexposed, where partly used for lighting, be so arranged and grounded that the lighting circuits have the lowest practicable voltage to ground.

(3) Circuits over 150 volts to ground. (See Rule 306.)

(4) Electric furnace and welding circuits. (See Rule 352.)

(*c*) *Grounding Non-Current-Carrying Metal Parts.*—Under the hazardous conditions named below, fixed electrical utilization equipment shall, when practicable, have the exposed non-current-carrying metal parts, such as frames of motors, cranes, cars and switchboards, cases of transformers and oil switches, and casings of wiring and conductors permanently grounded. (See Section 9, and for grounding of portable devices see Section 37.)

The following conditions shall be considered hazardous:

(1) All operation at voltages over 150 to ground, wherever equipment is located.

(2) All locations where explosives, inflammable gas or inflammable flyings normally exist in dangerous quantities.

(3) All cases where exposed grounded surfaces, such as metal frames of other machines, plumbing fixtures, conducting floors or walls, exist within the reach of persons when touching the metal parts under consideration. Usually grounded surfaces within 5 feet horizontally of the parts considered and within 8 feet vertically of the floor are considered "within reach."

(*d*) *Exceptions.*—Except in cases (2) and (3) under the preceding paragraph, no ground connection need be made to exposed metal frames of switchboards, motors or lighting fixtures connected to direct-current trolley or third-rail circuits, provided that such frames are effectively insulated from ground, and provided that the metal frames in question are so located with reference to insulating floors or platforms that persons cannot readily touch the metal frames in question without standing on such floors or platforms.

(*e*) Parts of machines, such as name plates, screws in wood, and similar small parts which are not liable to become alive, except under very unusual circumstances, are not considered as coming under the rule and may be left ungrounded.

*Section 9 is in the introductory portion of the Code. It consists of Rules 90 to 97, inclusive, covering methods of protective grounding of circuits, equipment and lightning arresters for stations, lines and utilization equipment.

305. Working Space About Electrical Equipment.

(*a*) Suitable working space should be provided and maintained about all electrical utilization equipment.

(*b*) The working spaces should, where practicable, have minimum horizontal dimensions, where adjacent to exposed live parts within 8 feet of floor, as follows:

(1) Parts above 150 volts to ground, if on one side, 2.5 feet; if on two sides, 4 feet.

(2) Parts below 150 volts to ground, if on one side, 1.5 feet; if on two sides, 2.5 feet.

(*c*) Where adjacent to such exposed live parts, working spaces should be so arranged that they will not be used as passageways.

(*d*) The elevation of the equipment at least 8 feet above ordinarily accessible working platforms affords protection at least equivalent to that provided by the horizontal clearances of (*b*), and may be used in lieu thereof, if desired.

306. Guarding or Isolating Live Parts.

(*a*) All ungrounded current-carrying parts of electrical utilization equipment, such as busbars, conductors and terminals, operating at over 150 volts to ground and not isolated by elevation at least 8 feet above floor line, should, where practicable (for exception see paragraph *b*), be provided with suitable permanent inclosures or other guards arranged so as to prevent persons or conducting objects from inadvertently coming (or being brought) in contact with the parts in question, and at the same time so as to permit ready access to authorized persons for making adjustments or repairs.

Inclosures may consist of suitable casings or suitable insulating coverings. The continuous insulating covering of conductors should be depended upon only when the circuit is grounded or entirely unexposed to leakage or induction from higher voltage circuits, and where it is impracticable to install more suitable guards. It should be depended upon then only when the covering is not exposed to liability of mechanical injury (see Rule 313 *b*), and is very substantial, thoroughly dry, and contains no noninsulating flame-proofing compound or oil-soaked rubber. It is recommended that in addition to the protection afforded by such coverings the insulating mats or platforms called for in paragraph (*b*) be used.

Where covers, casings, or barriers must at any time be removed from the otherwise exposed current-carrying parts which they guard, while these parts are alive, the covers, casings, or barriers should be of insulating material, or so arranged that they can not readily be brought in contact with the live parts.

Mats may be of wood, held together by wood pins, or of cork matting, linoleum, or rubber. The material and construction should be suitable for the voltage concerned and for the prevailing conditions. If subject to moisture or to accumulations of conducting dust, flyings, or chips, mats should present surfaces minimizing the hazards from these sources.

(*b*) Where current-carrying parts at over 150 volts to ground must necessarily be exposed (unguarded) within 8 feet from the floor line, all surrounding conducting floors and other non-current-carrying surfaces within reach shall be covered with suitable insulating platforms, mats or other insulating devices. (See Rule 305 for working space.)

The guarding of current-carrying parts will obviate the necessity for such insulating devices, and where the use of the latter is impracticable, from the nature of the location or processes carried on, guards should always be used.

(*c*) Except on fenced rights-of-way or other locations to which only qualified persons are admitted, trolley or crane collector wires and third rails, whether indoors or out, shall be so isolated by elevation (see Rule 116 and Section 24) or be provided with suitable guards so arranged that persons cannot inadvertently touch the current-carrying parts while in contact with the ground or with conducting material connected to the ground, and shall be provided with warning signs effective whenever the conductors are alive.

Damp wood, concrete floors, and metal parts of crane cabs are considered as grounded.

Trolley-contact conductors indoors shall be so supported that in case of a single break contact with the floor can not be made.

(*d*) Bare parts at different potentials shall be effectively separated. Such parts in circuits of large capacity or operating at over 300 volts shall, where practicable, unless provided with the inclosure or other guard specified in (*a*) above, be provided with suitable barriers, if otherwise they would be liable to be short-circuited by tools or other conducting objects.

307. Hazardous Locations.

(*a*) In locations where explosives, inflammable gas or inflammable flyings normally exist in dangerous quantities all parts at which sparking or arcing is liable to occur shall be so inclosed as to reduce the hazard as far as practicable.

(*b*) This protection should be obtained by one of the following methods:

(1) By placing in separate compartments or rooms, free from explosives, inflammable gas and inflammable vapors.

(2) By using casings of the inclosed type (ventilated, if necessary) when dust or flyings are present.

(3) By using explosionproof casings when inflammable gases exist in dangerous quantities.

(*c*) All casings shall be non-absorptive and non-combustible, and when of metal shall be permanently grounded, if within reach of grounded surfaces, or if inflammable gas is present.

308. Storage Batteries, Transformers and Lightning Arresters.

(*a*) The installation of non-portable storage batteries above 50 kilowatt-hour capacity, at the 8-hour rate of discharge, shall be in accordance with the requirements given in Section 13 of the rules for stations. Where small storage batteries (not included under Section 13) are placed in rooms used also for other purposes, adequate guards or inclosures shall be provided, when necessary, to prevent the approach of unauthorized persons, and special means of ventilation when necessary to prevent the accumulation of inflammable gas. For all batteries whose operating voltage exceeds 150, construction shall comply with Rules 133 and 306 *b*.

(*b*) The installation of transformers having either winding over 300 volts to ground shall comply with the rules of Section 14 of the rules for stations, and if the operating voltage of any winding exceeds 750 the transformers shall be made inaccessible to unauthorized persons. (See also Rule 304 *c* and discussion on Section 14.)

(*c*) The installation of lightning arresters shall comply with the rules of Section 18 of the rules for stations and, if the operating voltage of the circuit exceeds 750 volts, the arresters shall be made inaccessible to unauthorized persons.

309. Identification.

(*a*) All electrical utilization equipment shall be suitably identified, when necessary for safety.

(*b*) The identification may be by position, color, number, name plate, label, design or other means.

(*c*) The voltage and intended use shall be shown where important.

DISCUSSION OF SECTION 30.

300. Scope of the Rules.

In workshops, mercantile establishments and similar places more reliance must be placed on physical guards about the current-carrying parts of electrical utilization equipment and less reliance on the precautions of workmen than in supply stations where station equipment only is concerned. As a general principle all such current-carrying parts should be guarded except those requiring frequent inspection and repair by authorized employees, but these parts should be made inaccessible to other persons. Parts at very low voltages may be considered as exceptions to this general requirement for guarding live parts, since the degree of danger is so much less than with higher voltages. Depending upon the character of equipment and degree of hazard involved, the rules for guarding parts at lower voltage are waived, within stated limits.

However, utilization equipment made inaccessible to all but authorized attendants frequently approximates the conditions in supply stations which are dealt with in Part I, and under such conditions the less rigid requirements of those rules apply. On the other hand, any such less guarded equipment should be carefully separated from any non-electrical processes which might seriously distract the attention of the operator, even where properly qualified for electrical work, from the necessary care in handling unguarded current-carrying parts.

301. Application of the Rules.

It will, in general, be found less frequently advisable to modify or waive the utilization rules than perhaps may be permissible with station or line rules, since the modification or waiver of a station or line rule can be accompanied by an appropriate change in operating precautions in which the workmen can be duly instructed. Electrical operating precautions for workmen whom it is not feasible to thoroughly instruct in electrical operation, and whose attention must be principally given to other processes, cannot, however, be considered equivalent to the provision of physical safeguards such as are called for in the utilization rules.

Experimental installations and methods of construction and operation should, in general, be allowed by administrative authorities whenever they are satisfied that the experiments entail no excessive hazards and might lead to improvements in the art. The administrative authorities under such circumstances should sufficiently supervise and subsequently inspect the installations so that the advantages or disadvantages of the experimental installations may be determined in comparison with the methods specified in the rules.

302. General Requirements.

Electrical equipment is available from reliable manufacturers to meet the requirements of these rules. Proper care, however, must be exercised to select equipment which is satisfactory both for the work to be done and for the location where it will be used. Before proceeding with an installation careful study should be made of the atmospheric conditions and character of load.

After equipment is once installed no change in operating conditions should be made until it is known that the equipment is capable of safely meeting the new conditions. In selecting material or devices to properly meet conditions in compliance with the rules, reference to reports on these materials or devices, by Underwriters' Laboratories or other properly qualified body, will remove the necessity for frequent repetition of tests on the same materials or devices in different cases, and such uniform examinations and reports are of great assistance to manufacturers and users alike in assuring that the products concerned meet a reasonable standard of safety to life and property.

303. Inspection and Repairs.

The inspection of electrical utilization equipment and wiring before placing it in service is even more important than with station equipment, since the operator of station equipment may, by reason of his electrical training, be relied upon to some extent to detect and repair or remove defects which may endanger property or life, whereas utilization equipment will not be under such expert observation and any electrical defects may go unnoticed and, of course, uncorrected until an accident occurs.

With some kinds of electrical equipment it is essential that cleaning be done occasionally, as, for instance, with motors, especially where oil or dust may collect on windings. A periodical inspection should be given to electrical utilization equipment of all kinds. Such inspection will aid in detecting abraided or oil-soaked insulation and similar defects before they become serious or cause accidents or interruptions to service. Such inspections should be made by properly qualified employees at reasonable intervals, according to the character of the equipment and the severity of the conditions to which it is subject. Much can also be done, through occasional inspections by owners or tenants, toward eliminating abraided portable cords supplying mechanical protection to wires in exposed locations and like minor matters.

To maintain electrical equipment at a proper standard, any necessary repairs should be done only by properly qualified persons. A machinist, a coal miner or a householder can hardly be expected to repair motors or wiring, the use of which is incidental to the work in which he is engaged, as well as would a qualified electrical workman. Many accidents occur from defective electrical equipment, the defects of which are the result of attempts at repairs by persons not properly qualified to do such work.

304. Grounding.

(*a*) The grounding of equipment for protection of persons must be thoroughly reliable, or it gives a false sense of security. To obtain reliable grounding requires very careful consideration of the attendant conditions. Since the method is, in general, the same for grounding, whether in stations, on lines or for utilization equipment and circuits, and the requirements are necessarily considerably detailed in order to provide a useful guide, it has been deemed best to place these detailed rules in Section 9.

(*b*) The grounding of circuits as a protective measure is entirely for the purpose of preventing persons or insulation being subjected to a voltage to ground higher than the normal voltage to ground of the circuit for which it is insulated and guarded. All circuits which are so exposed to other circuits that their voltage may be increased by contact with them, or by breakdown between transformer windings or by electromagnetic or electrostatic induction, should be either recognized and guarded as circuits of the highest voltage to which they are exposed or should be so grounded that a dangerous increase of voltage cannot take place between them and the ground or conducting objects, such as telephone equipment, radiators and plumbing, which are intimately connected with the ground. Guarding low-voltage devices and circuits sufficiently to protect against high voltage is impracticable, and protection must therefore generally be by grounding.

Certain cases occur in which the advantage of grounding the circuit seems insufficient to warrant its requirement, as follows:

(1) Two-wire direct-current circuits of isolated plants are frequently entirely unexposed to higher voltages and the grounding can not decrease, while it may increase the liability of shock to persons coming in contact with current-carrying parts or frames of connected apparatus. Two-wire direct-current commercial circuits are likely to be underground and unexposed, but even where carried overhead so as to be exposed they may, by grounding, cause electrolytic damage. The balance of advantage is considered to lie with the insulated system and grounding is not required. (See Rule 92 *a* in Section 9.)

(2) Circuits unexposed to higher voltage either directly or indirectly are not necessarily made safer by grounding one side, and may even be made more dangerous than they would be if kept *entirely* free from grounds. If of large extent and serving many consumers, the chance that they can be kept *entirely* free from grounds is, however, so remote that usually the ground connection is harmless and *may* reduce unexpected hazards from unknown exposures to higher voltage circuits.

No ruling is made on this point and the judgment of the utility will govern in the absence of action by the local authorities. Where unexposed circuits are three-wire (not three-phase) a great advantage follows the grounding of the neutral, since the voltage to ground of connected apparatus can then be only one-half what it might become through accidental grounding of an outer wire on an ungrounded circuit; and in practice such accidental grounding, often slight, but sufficient to cause dangerous shocks, is recognized as a common circuit condition. This advantage is so pronounced that even with direct-current three-wire circuits it is considered to overcome the disadvantage of possible electrolytic damage and, in general, to call for the grounding of the neutral, although in this case such grounding should be restricted to one point of the circuit. Such circuits are usually so grounded in practice, even where run underground or otherwise entirely unexposed to higher voltage circuits.

(3) Circuits over 150 volts to ground are not definitely required to be grounded, since serious shocks are possible from the normal circuit voltage, and these would not be eliminated by grounding, but guarding must be depended upon for protection in any event. By Definition 21, and Rule 306, it will be noted that dependence is placed upon guarding rather than on the insulating covering of conductors, since this is not considered suitable as a guard for ungrounded circuits, even below 300 volts, if these are elsewhere exposed to leakage from higher voltage circuits, although sometimes permissible for grounded circuits up to 300 volts, where not exposed to mechanical injury, as near floors. Many engineers consider grounding highly advisable for the highest voltage circuits used for utilization equipment, if these circuits are anywhere exposed to leakage from higher voltage circuits, since it is impracticable, as noted above, to provide devices or circuits with sufficient insulation to protect against high voltages which might be imposed on them by crosses in storms or from other causes.

(4) The majority of electrical furnaces and welders use a very low voltage circuit. The insulation between these circuits and their grounded frames (see Rule 351) is of low value, and small abnormal rises in voltage would break this down and automatically ground the circuit. Special grounding provisions are not necessary for such circuits, and ground connections of sufficient capacity would often be difficult to obtain.

(*c*) Parts of the apparatus which are normally not current-carrying sometimes become alive through failure of insulation. Grounding will prevent the existence of a dangerous voltage on non-current-carrying parts, such as transformer frames and cases, motor frames and conduit. The higher the operating voltage of the equipment, the more imperative is the necessity for the protection afforded by such grounding. In locations where explosive gases are present grounding is always necessary, even at the lowest voltages, since even a small spark, due to leakage current from an ungrounded frame to some conducting material in the vicinity which is in contact with the ground, would be liable to cause an explosion. Where equipment is located so that workmen might otherwise unsuspectingly receive a shock by coming in contact with the equipment frame, by reason of the existence in the immediate neighborhood of well-grounded surfaces, such as those provided by plumbing fixtures or damp floors, the grounding protection should be provided even with equipment operating at the comparatively low voltage of the common 110-volt system.

305. Working Space About Electrical Equipment.

Failure to properly guard moving parts of machinery where crowded gives rise to one of the most hazardous mechanical conditions in workshops. The exposure of live parts of electrical equipment employed in connection with the machinery of workshops is a similar hazardous condition, the hazard increasing with increasing voltage. With restricted working space and inconvenient access, electrical equipment is also liable to suffer from inattention and insufficient cleaning more than where liberal working space is provided adjacent thereto, and rapid deterioration will continue until a condition is reached when the electrical equipment becomes hazardous to the attendant. The proper amount of working space will vary with each particular installation, and more liberal working spaces than those required in the rules will frequently be found desirable and thoroughly feasible. The installation of electrical utilization equipment after the plant has been built and other machinery set sometimes produces a crowded condition which may become dangerous if some positive minimum working distances are not strictly adhered to.

Owing to the reduced probability of persons coming accidentally in contact with exposed live parts where these are elevated considerably above the space ordinarily occupied by machine attendants, elevation, where feasible, of the live parts may usually be considered as at least equivalent to providing more liberal working spaces adjacent to live parts were they nearer to the floor line. For example, it is sometimes good practice to install motors above the heads of the machine attendants so as to reduce the probability of accidental contacts, thus avoiding the necessity for inclosing the brushes and other live parts which would exist were the motors placed on a level with the workmen.

306. Guarding or Isolating Live Parts.

The complete guarding of live parts when persons are near them would, of course, eliminate shocks and burns from electrical causes. With electrical utilization equipment suitable guarding is the more necessary, since the attention of the employee must be given to the processes and ordinary activities carried on in the given building rather than to the electrical machinery, which is only incidental or auxiliary. Wherever practicable, live parts should be so placed or guarded that only specially qualified electrical employees will have ready access. Frequently this is accomplished to some degree by placing motors or other equipment on the ceiling or under the floor and providing well-guarded starting and control devices convenient to the operator of the machine concerned. Individual drive motors are often placed out of reach on top or underneath the machine driven. In some shops the handling of pipes or rods makes even a considerable elevation ineffective. Eight feet is named in the rule as about the greatest height to which the average person can reach with his hands without standing on a chair or other support. Live parts at a lower level, and sometimes at higher levels than 8 feet, should generally be guarded against contact by one of the methods outlined in the rule. Complete inclosures for otherwise exposed live parts usually provide the most satisfactory protection, since they prevent short circuits, by tools or conducting material in the hands of workmen, as well as shocks by direct contact. Where inclosures are not feasible, efficient barrier guards may be used.

In some cases insulating platforms surrounding the live parts will prevent shocks to workmen in the vicinity, but they are less effective in preventing the almost equally dangerous short circuits which frequently occur from accidental contact of tools or materials in the hands of workmen. Such platforms, if used, should be suitable for the conditions, and where dampness or oils are present many types of insulating platforms, especially wood or other absorptive material,

become relatively ineffective and other forms of protection should be used. Much better standardizing of insulating mats and platforms than exists today should be brought about by development of suitable detailed requirements. It seems probable that rubber mats of sufficient thickness and properly prepared so as to be free from metal chips or mineral filler, which would reduce their insulating value, would be very suitable either in damp or dry locations if no oil, metal dust or metal chip accumulations are to be expected.

Where the materials handled include metal rods or pipes or other conducting materials, the insulating platforms, if used, would need to be of very considerable extent beyond the live parts in order to be effective, and it will thus be found that the field for use of insulating platforms or mats as a protection for workmen against shock from utilization equipment is very restricted and other more positive forms of guarding will usually be necessary. (Compare Rule 304 *d*.)

307. Hazardous Locations.

The Bureau of Mines has approved certain types of motors as explosionproof and is prepared, upon request, to test other motors and approve them if satisfactory. (See Technical Paper No. 101, issued by the Bureau of Mines, Washington, D. C.)

308. Storage Batteries, Transformers and Lightning Arresters.

The advisability of providing a fireproof inclosure for transformers and other apparatus having considerable oil in contact with the windings is even greater with utilization equipment than in the case of stations, since the surroundings are more frequently combustible, and the greater number of employees, together with their probable lack of electrical training, tend toward greater property loss as well as increased danger of panic and accident in case of rapidly spreading oil fires from such oil-insulated apparatus.

Lightning arresters in general may be placed on overhead lines and their use within buildings other than stations may thus be avoided. It is advisable, where they are for any reason placed within the building, that they should be made inaccessible because of their possible danger to persons in the vicinity during violent discharges. Although it has been felt by some to be unreasonable to require lightning arresters, even where low-voltage distribution circuits are considerably exposed, their use is recommended as a protection to the equipment and devices attached to such circuits within buildings if the outside circuit is exposed in overhead construction for a considerable distance, say 1000 feet or more, in locations subject to severe lightning.

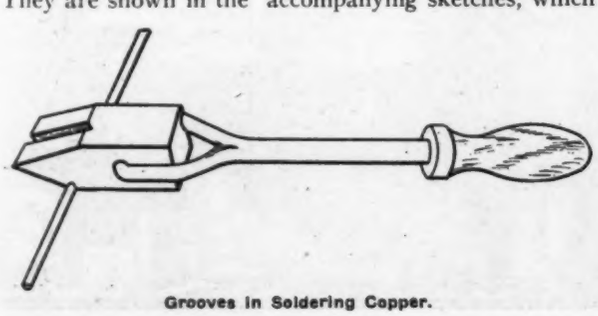
309. Identification.

The ability to readily identify and trace the connections of equipment not only facilitates repairs but safeguards against the danger of handling live parts in the mistaken belief that they are disconnected. As a safeguard the identification should at least be sufficient to indicate the voltage and the intended use of the equipment or connection concerned. It is particularly desirable that the automatic cutouts protecting any circuit should be labeled to show the destination and character of the circuit concerned. Where, as is usual, such automatic cutouts are grouped in a cabinet or on a panelboard, such identification often provides the principal means for tracing the connections of the installation.

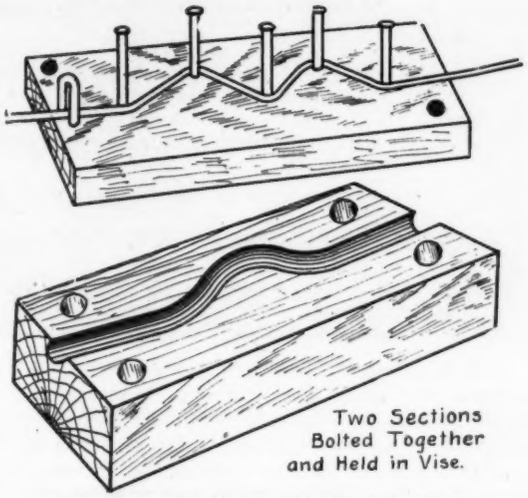
A FEW SOLDERING AND WIRE-STRAIGHTENING HINTS.

By Charles H. Willey.

While visiting a neighboring plant, the writer was shown a couple of helps that he considered to be pretty good, and they may find favor with others. They are shown in the accompanying sketches, which hardly need descriptive matter. The soldering copper is ordinarily a slippery tool to tin or solder wire with, but by cutting a V in both faces, as indicated, the solder is easily directed, and the work made easy.



Grooves in Soldering Copper.



Two Blocks for Use in Straightening Wire.

The wire straighteners shown are quite simple, yet serviceable, and when one has any quantity of wire to straighten, they will be appreciated. The one shown in the upper part of the sketch consists of heavy wire nails and a hardwood block, and is suitable for small wire. The one shown in the lower part of the sketch is for larger sizes and is made from two sections of hardwood, the wire to be pulled through by tackle and wire puller.

AMONG THE CONTRACTORS.

R. V. Carrier & Company, Chicago Heights, Ill., are putting in the wiring and fixtures for the new office of Chalmers & Williams, machinery manufacturers, Chicago Heights.

The G. E. Engineering Company, 417 Canal Street, New York City, has received the contract for installation of an electric light and power system at Anacostia, D. C., at a contract price of $10,540.

H. A. Clark & Company some time ago opened an appliance store and contractors' office at Chicago Heights, Ill. The firm is handling some outside work in that section.

The Electrical Construction Company, 604 Mission Street, San Francisco, Cal., has been awarded the contract for installing an underground electrical distributing system at Fort MacArthur, Cal., at a contract price of $19,436.

William A. Mullins Electric Company, 931 Broadway, Tacoma, Wash., has the contract for installing Brascolite lighting fixtures in the billiard room at Camp Lewis, which is said to be the largest room of this kind in the United States. A special sales campaign was recently completed by the company during which it sold 75 washing machines in 20 days.

Among contracts recently secured by the Milwaukee office of Henry Newgard & Company was the complete electrical installation in Columbia Hospital, Milwaukee, Wis. This included 180 horsepower in motors, 1800 outlets for lighting, 70 nurses' call stations (the Bobroff system), 110 telephone stations, X-ray equipment, etc. Contract was also secured for all the electrical installation in the nurses' school.

Contractor-Dealer

Description of Sales Campaigns, Window Displays and Advertising Methods of Progressive Contractor-Dealers

A FORM OF CONTRACT FOR SELLING APPLIANCES ON EASY-PAYMENT PLAN.

Contract forms used by dealers in selling washing machines and other electrical household appliances on the long-time, easy-payment plan differ considerably, but in all forms adopted the dealer reserves the right to reclaim the machine in cases of failure to meet the payments. In some contracts this prerogative of the dealer is expressed in exacting terms, while in others there is an evident intent to make the terms of sale such as will not be objected to by the reliable purchaser. If a machine be taken back on account of failure to complete payments, the matter of retaining the sum which has been paid as rental, damages, etc., is one to be determined by each individual case. Some sales contracts contain this retention clause, while others do not, evidently leaving the matter for adjustment.

We give below a form of sales agreement between the dealer and his customer who buys a washer, for instance, on the easy payment plan. This form has been used by a large retail dealer, with excellent success:

"Date ....., 191...

"With the understanding that I am fully protected by your guarantee, you may deliver to me one ..... Electric Washing and Wringing Machine, No. ..... I am paying you $..... herewith, and will pay $..... per month to you until machine has been paid for in full. Total price $....., including interest at five per cent. The machine remains your property until fully paid for.

References ..... Name .....
..... Address .....
..... Business .....

GUARANTEE OF ..... COMPANY.

We guarantee that this machine has been tested and found up to our standard of efficiency and is absolutely free from imperfections in material and workmanship. We agree to replace free of charge and without cost to the purchaser, any part or parts proving defective either in material or workmanship, ordinary wear and tear, accident and misuse excepted."

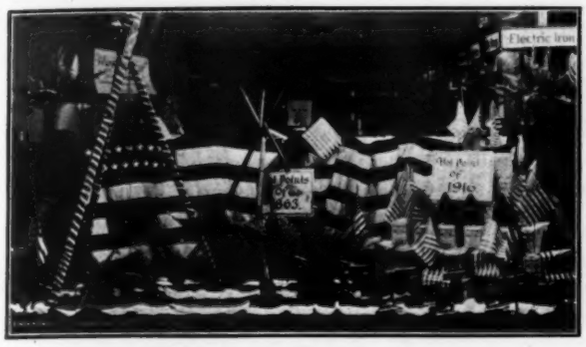
The usual plan is to secure a payment of 10 per cent down, and provide for 12 monthly payments. Such sales contracts of various forms are tangible enough to serve as collateral at banks. In fact, they may be regarded as trade acceptances, representing goods sold in small amounts.

In connection with appliance sales by the contractor-dealer it is usually the plan and practice of the manufacturer and jobber to render all sales helps possible in the way of catalogs, descriptive circulars, etc.

SALES POLICY OF A PROGRESSIVE JOBBER.

A well-balanced window display of miscellaneous electrical household merchandise is that of the Central Electric Company, in its Chicago store, a clear illustration of which is given herewith. This company has adopted a method of helping on the sales of its dealer-customers by supplying a catalog of "Things Electrical" for the retail merchant to distribute to home customers. This catalog is a 65-page book containing descriptions, cuts and retail prices of practically every article in the line of electrical merchandise, and in many cases several types of each kind. Each article is designated by name and number. Any dealer who has made purchases of the Central Electric Company up to the requisite amount is supplied with catalogs for local use. In such cases the name of the Central Electric Company does not appear on any part of the catalog, but instead the local merchant's imprint is given thereon. He sends them out as his own catalogs. Last year the Central Electric Company printed and circulated among its dealer-customers about 100,000 copies, and the plan was found so effective in promoting local sales that a similar edition will be issued later in 1918 for the holiday trade; and, of course, any plan which results in increasing the sales of the dealer means better and bigger business for the jobber.

Attractive Window Display of the Central Electric Company, Chicago.



Patriotic Decoration Day Trim.

Iron Window Trim at Oak Park, Ill., Store.

PUBLIC SERVICE COMPANY'S SCHEDULE OF APPLIANCE SALES FOR MARCH—TYPICAL WINDOW DISPLAY.

Public Service Company of Northern Illinois has made up its schedule of appliance sales for the year, the March schedule providing for special efforts, at its numerous stores, on the sale of Toasters, Ironing machines and Thermophone heaters. The April schedule includes sewing machines and sewing-machine motors. The company's Sales Bulletin of March 1 contains illustrations and reading matter descriptive of its March leaders. Not only is the toaster considered, but the toast itself, the product of quick, even heat. This method of sales promotion is supplemented by attractive window displays in all the company stores, also by personal calls and demonstrations. Herewith are given illustrations showing Public Service Company window displays. These are typical of the skill and effectiveness with which this phase of advertising is utilized. The Thor ironer is in like manner presented in the March 1 bulletin, and is well displayed in the company's store windows. The sale of the ironing machine comes as the logical aftermath of selling an electric washer. The Thor ironer is made in different sizes. It is gas heated and is also motor driven.

The plan is to rearrange the window displays every two weeks, and oftener in some stores.

The plan the company inaugurated in February, under which all employees, except regular salesmen and superintendents, are paid a commission of 5 per cent on appliance sales made by them, is proving successful. During the first month's trial there was a marked increase in sales. This plan was fully explained in our issue of February 22. Employees who take advantage of the offer are engaged in the various departments other than that pertaining to regular sales, and are to solicit appliance orders after regular hours among those who are now the company's customers. Some of the employees, at the end of February, came through with handsome commission credits.

VACUUM-CLEANER SPECIFICATIONS.

In selling stationary vacuum cleaners, the lack of standard specifications has caused much lost motion and waste of time among architects, engineers and sales representatives.

Complications, misunderstandings and even expense have naturally resulted from such a condition. In an effort to cope with this situation the United Vacuum Appliance Company, Connersville, Ind., has gotten up a small filing card, which is crammed full of condensed information.

the Connersville vacuum pump, together with blanks to be filled out by a contractor so that he can quickly and fully describe the cleaner on which he is bidding.

On the reverse side the main items of importance are specified under each of the important headings. Such an arrangement will prove most valuable to the younger architects and engineers as well as very helpful to the more experienced ones.

A very handy and unique feature of the card is its arrangement. It is adapted in size to fit either a standard 4 by 6-inch or 3 by 5-inch filing case.

HOW THE DEALER CAN MEET THE PROBLEMS CAUSED BY RISING PRICES.

Dealers everywhere are asking "How can we meet the problems forced upon us by the high and rising prices of merchandise?"

The most serious of the problems confronting the dealer on account of the high prices is probably the increasing demands for capital to maintain his stock and conduct his business.

There are three practical methods of meeting these problems, which any dealer can apply to his own business.

In the first place, the dealer should restrict the extension of credit to his customers. That dealer who feels that he is under obligation to finance his customers and do it gratuitously, has a misconception of the functions of a retail merchant. He is confusing his functions with those of the banker. There is no more reason why he should furnish the capital for his customers to live on, than that they should advance the capital for him to do business on. If the dealer should suggest such an idea to his customers, they would be prompt in advising him to go to the bank for his capital, and they would be right in doing so.

And so is the dealer right in insisting that his customers patronize the bank, for this is its proper function.

No apologies to the customer are necessary for refusing to extend credit. It is only straight out and out business.

It is to the advantage of the dealer in a number of ways. Instead of having from $1,000 to $10,000 on his books, as many dealers constantly do, he has this capital free to work for him. He can take advantage of his cash discounts which in itself represents a considerable addition to his profits in the course of a year. It avoids the possibility of losses through bad debts from irresponsible credit customers, or as a result of sickness or death on their part or their moving out of the community. He has a smaller amount of capital involved, and hence need not

charge off such a large amount of interest on capital invested.

And all these advantages result in a decreased cost of doing business, and greater profits.

Furthermore, the cleaner the dealer's collections, the sounder the business, the better the inventory, and the better the showing on the balance sheet, which means a better showing to the bank and a greater good-will value to a prospective buyer.

It is to the advantage of the customer in two ways. In the first place, it will curb any tendency to extravagance which results from too easy credit. It will make him a more careful buyer. And in the second place, he will benefit indirectly through lower prices resulting from the dealer's decreased cost of doing business on a cash basis.

The second practical method of meeting high prices is for the dealer to carry smaller stocks, and hence require less capital. There are very few dealers who cannot cut down the size of their stock by a very considerable amount—some of them at least half—by buying fewer brands in each line and buying in smaller quantities and oftener. If dealers will analyze their stocks carefully most of them will find a number of offbrands of slow-moving, non-standard merchandise which they could eliminate from their stock and release the money tied up in them. Any merchant can satisfy the demands of his trade with a few, good, well-known standard brands. By buying in needed quantities and oftener, he can turn his capital a great number of times per year. And furthermore, he will always have fresh, new goods on the shelves, which are trade-marked and are an inspiration to the clerk in selling, and a greater satisfaction to the customer in buying.

He will also be more likely to follow declining price tendencies closely and avoid speculation in big investment in stocks.

And finally, the third practical suggestion for helping to meet the present high prices is, to cut down the cost of doing business. This can be done not only by restricting the extension of credit, but by concentrating on and pushing standard, advertised brands of merchandise. Every merchant has found from experience that the standard, advertised brands move faster and with less selling effort than the other brands.

Standard goods are readily accepted by the customer and hence the clerk can wait on a greater number of customers per day.

Furthermore, by utilizing the selling helps usually furnished by the manufacturer of standard goods, by the use of window displays, store and counter displays, and cuts in his local advertising, he can stimulate his sales, get new customers and increase his volume of business all with the greatest economy, and resulting in lower costs of doing business.

And in addition to all these considerations, the dealer can sell standard merchandise with greater assurance that they will give complete satisfaction to his customers.

Standard merchandise builds good will for the dealer who sells it.

SUCCESS MEANS CUSTOMER MUST BE SATISFIED.

One of the requisites in selling electrical merchandise is to sell in such a way that the goods will stay sold. This has special reference to washing machines, vacuum cleaners, cooking ranges and similar household utilities. In order that a machine or appliance may stay sold it is necessary that the salesman and the merchant keep in touch with the customer and see that it works satisfactorily and that there is no cause for a well-founded grievance. If the customer is not pleased with the transaction, is not speaking well of the machine to her friends and neighbors, the sale is not a success, even though all payments may be promptly made. The selling of such articles, then, entails faithful and courteous attention after the order is signed and a payment is received. A satisfied customer for one appliance often finds a way to buy others.

Prize-Winning Vacuum-Cleaner Window Display

FIRST prize in a recent window-display contest, conducted by the Apex Electrical Manufacturing Company, Cleveland, O., among its vacuum-cleaner dealers, was won by the Electric Supply Company, Clearfield, Pa. The display, shown herewith, was designed to show the various uses of the cleaner in the home. There were 350 entries and seven prizes were awarded, the winners, in addition to the Electric Supply Company, being the Ft. Scott and Nevada Light, Heat, Water & Power Company, Nevada, Mo.; F. W. Bunn, Mishawauka, Ind.; M. E. Pierce, Canton, O.; H. A. Schlabugh, Goshen, Ind.; J. S. Nielsen Electric Company, New Haven, Conn., and the Henry M. Moses Electric Company, Columbus, Ga.

The Apex company created considerable interest among electrical dealers by the contest. Helps in the form of suggestions, window cards, literature were furnished without cost and information

The judges were selected from the leading newspapers and awards were made on originality of design, effectiveness of display and pulling power of window with regard to Apex cleaners

A Training School for Vacuum-Cleaner Salesmen and Its Results

How a Prominent Manufacturer Schools Salesmen to Understand and Sell Cleaners—Open to Dealers' Salesmen

By CHARLES J. JAMES

Assistant Sales Manager, United Electric Company, Canton, O.

THE vacuum-cleaner industry is a comparatively new business; especially the manufacturing and selling of the light portable electric machines, which have only come into general use in the past six years.

Like all other new devices that have revolutionized conditions of living, it has passed through the various stages of evolution. The first crude machines of the portable type were regarded as novelties and of little practical use. It was a hard uphill fight for the manufacturer of these machines to educate the housewives of the nation to throw away the broom and carpet sweeper and purchase electric vacuum cleaners to replace them. Hundreds of thousands of dollars have been spent in educating the public. The hard work and money so spent, however, have accomplished their task, and today practically every woman knows what an electric vacuum cleaner is and what a valuable assistant it is in the home.

After educating the public to the virtues of the electric cleaner, the manufacturers have had an equally difficult and often expensive problem to solve, viz., how to secure reliable and efficient salesmen to sell their product.

When the machines were in the novelty stage of development most of them were sold, as are all novelties, by house-to-house canvass. Since passing the novelty stage and settling down to a merchandising basis they are now sold as a high-grade specialty; but even now it is more or less difficult to interest high-grade sales people to enter the business, because they still think of it as being in the early stage of development, and do not care to become peddlers or canvassers.

It was to correct this impression and educate high-grade salesmen and women how to sell Ohio-Tuec cleaners intelligently and profitably that gave the United Electric Company, Canton, O., the idea of establishing a training school. Its dealers and distributors were constantly calling for salesmen. War conditions have made good, reliable help harder to secure and only a small percentage of those who have been hired have been successful because they did not know how to get started.

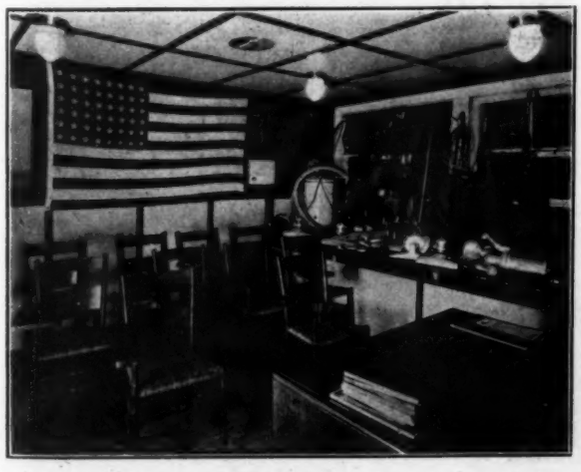
We laid our plans for the opening of the training school early in December of 1917. It was necessary to write a textbook which was to be the foundation upon which the course of instruction was to be based. Work on this was started immediately.

A schoolroom was fitted up in our factory complete with chairs and blackboard. Panels on which were mounted all the parts used in the manufacture of the Ohio-Tuec cleaners, each part being named and numbered, were also hung on the wall, together with a blueprint showing the relative position of these parts in the assembly of the machine.

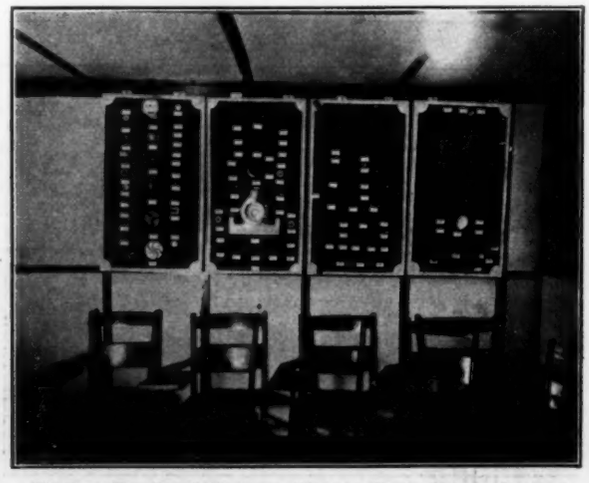
All of our distributors and dealers were written, and the object of the school explained to them very thoroughly. They were requested to send as many students as possible to attend the classes. The capacity of the school was limited to twelve students in each class. Everything was ready by January 1, and our first class assembled on Monday, January 7.

The course of training covers a period of two weeks, the first week in the factory schoolroom, and the second week in actual selling under the direction of experienced instructors.

The training given during the first week in the schoolroom covers all phases of the business. The first thing necessary for the embryo salesman to learn is a thorough knowledge of our product, also a knowl-



All Makes of Cleaners Are Studied by the Salesmen-Students.



Display Panels of Vacuum Cleaner Parts Forms Part of Instruction.

edge of our competitors' products. The mechanical construction of the machine is gone over very thoroughly, so that each student will know the use of each part and its relation to every other part.

Having gained a knowledge of the product, how it is made and what each part is for, the next step that is necessary is a knowledge of how to properly show and demonstrate the machine, followed by a knowledge of the proper answers to any arguments or objections brought up by the prospective purchaser, and finally the best arguments to use to close the sale. Each student is required to give a sales demonstration to each other student, other members of the class meanwhile making notes on the points overlooked by the one giving the demonstration.

We have outlined seven things that are necessary to successfully sell Ohio-Tuec cleaners. Each student is taught that he must use these seven points in his daily business after he has graduated:

First: KNOWLEDGE. A thorough knowledge of our product and of all of our competitors' products.

Second: ENTHUSIASM. Enthusiasm, well directed, is impossible without a thorough knowledge of the product that you are endeavoring to sell.

Third: AN ABILITY TO CONVINCE. Without knowledge of our product and our competitors' products, and without enthusiasm, it is impossible for a salesman to be convincing.

Fourth: INDUSTRIOUSNESS. Knowledge, enthusiasm or ability to convince will not avail unless the salesman uses them—unless he works.

Fifth: THOROUGHNESS. The student is taught how to work intelligently, to cover the subject thoroughly, and to explain the details and operations of the machine in a simple and convincing manner.

Sixth: TRUTHFULNESS. Lies are always a false defense used to bolster up a salesman's lack of faith in himself or his product, or both. If the salesman selling our product has a thorough knowledge of it, and believes that it has the merit, he will be enthusiastic; he will have the ability to convince without the necessity of being untruthful.

Seventh: LOYALTY. The old saying, "An ounce of loyalty is worth a pound of cleverness," holds good in the vacuum-cleaner business as well as in any other; and if the salesman believes in his product and his employer he should always be loyal.

The results obtained through the school have been far beyond our fondest expectations. We have received numerous letters from students who have attended the school brimming over with enthusiasm for the help that it has been to them.

Up to the present writing we have had many students from all over the United States and Canada, and have every reason to believe that the establishing of the school will mark the beginning of a new era in the industry.

First Graduating Class of Vacuum-Cleaner School.

Corner of Schoolroom Where Demonstrations Are Made on Blackboard.

WELL-LIGHTED STORES PROMOTE CHEERFULNESS AND CONFIDENCE.

Discussion of the Effect of Lightless Nights on the Prosperity of the Small Merchant.

There are perhaps 750,000 small stores and shops in this great country—three quarters of a million small shop-keepers trying to be independent and to support their families, which constitutes nearly 5 per cent of the total population of the country. A cheery front is about the only means of advertising these little stores; but how much that cheery front means to this nation of ours.

Suppose you live in a small town or a suburban neighborhood. As you come "downtown" after supper on Saturday night, and everybody is out, how cheerful it looks down toward the square. The show windows are bright and attractive; the electric signs contribute their part. And how the people seem to enjoy it. The brightness and good cheer stimulate the desire to spend money, and this means support for many people. The abundant light breeds confidence and courage and brings the people together. Just now it is especially important that the farmer and the artisan should be reached and their purse-strings loosened for the aid of their country. And yet there are thoughtless ones who say, "No, no; darken down. Bring on the gloom and depression. Courageous cheerfulness is unpatriotic; it takes the coal; it must not be."

And yet, how little coal it does take to produce these brightened store fronts all over the country—four pitiful pounds per year for each man, woman and child in all the nation. It is to save four pounds per individual that the country must be plunged in comparative gloom, threatening the livelihood of over four millions of people, whose principal chance of supporting themselves depends upon their becoming and continuing known to their neighbors through the medium of the cheerful front. Further, millions of

The Small Establishment Must Depend Almost Entirely on the Electric Sign for Its Advertising.

workers who ordinarily find innocent recreation under the bright lights of the streets of our communities are depressed, while financial and industrial activities are impaired.

There seems to be coal enough to haul thousands of the leisure classes to far-off pleasure resorts; there is coal enough to print and transport to the country's ends millions of tons of the advertising of the rich corporations; there is coal enough to overheat whole townships of office buildings. But for the sort of advertising which is practically the only kind open to the small merchant and which yields more dollars' worth of pulling, business-building publicity per pound of coal used in its production and distribution than any other kind—for this kind of advertising there is a coal shortage. And this, too, is the kind of advertising which has a benevolent side, for while it benefits him who employs it, it also sheds its good cheer on all passers-by and it instills a feeling of well-being, comfort, confidence and courage on all who come within its influence.

Against this form of lighting publicity, good cheer and encouragement, some superficial critics, the untrained and the busybodies, must raise their hands in self-righteousness and declare that it is unpatriotic.

But wait. Some great man will yet appear with intelligence to discern and analyze, and with courage to express his convictions, who will make this answer: "Unpatriotic, O ye of small understanding, misguided ones. Nothing is so cheap at any price as cheerfulness and courage and confidence; and here you have it almost for nothing. Compared with other useless and wasteful methods which are being followed under your eyes but which you do not seem to see, the cost of this light is as nothing. Let him who in the honest support of his family and without interfering with his country's work, spreads light and cheer, be known as a patriot. Let his electric sign, which uses far less coal than its equivalent in printed advertising and cheers and protects his neighbors into the bargain, be the sign of patriotism. Let his critics forget their mistaken point of view and get busy. Let him help as much as he does in laying a foundation on which to sell the country's bonds and to give rest and courage and cheer to the workers, thus helping to win the war."

FIXTURE DEALERS MUST EDUCATE CUSTOMERS TO MODERNIZE THEIR LIGHTING INSTALLATIONS.

During this period of comparatively limited activity in residence building, the efforts of the lighting fixture dealers are necessarily directed to the sale of fixtures for use in existing homes. At a time when the walls and ceilings of a house are being newly decorated is a proper occasion for the installation of new lighting fixtures which not only will render better service, but will give superior artistic effect. An idea that may be emphasized by the dealer is that lighting fixtures are for both utility and beautifying effect, and the suggestion can hardly fail to appeal to persons whose purpose is to make the home beautiful. Fixture manufacturers are fully keeping pace with the times in bringing out new designs for producing the even, soft glow of light desired, and so that fixtures may be selected that will conform to and properly balance with the general plan of artistic finish.

It is suggested by a prominent fixture manufacturer and jobber that local dealers may greatly aid the prospective customer by making displays of fixtures of modern designs in separate sections of their stores. Such displays may illustrate different plans of home decorations, with advantageous changes of fixtures, avoiding the appearance of monotony. Those displays, constantly freshened by rearrangement and new units, have an excellent educating effect among home makers, by which their ideas of good taste and design keep in touch with the best things in the trade.

Fixture manufacturers and jobbers are devoting special attention to sales helps, intended to assist the dealer in increasing sales. One of the helps is in the nature of descriptive booklets of fixtures, bearing the dealer's imprint. Another is to furnish the dealer a series of advertising plates which may be used in connection with local newspaper advertising.

An Unusual and Attractive Fixture Display Room.

Electric Vehicles

Electric Vehicle a Factor in Transportation Engineering—Other Data on Electric Vehicle Operation and Economy

OPERATING COSTS OF A TWO-TON ELECTRIC TRUCK.

The cost of the working of a 2-ton Edison electric vehicle at Newcastle-upon-Tyne, England, for 41 weeks has been published by J. W. Thwaites.

The number of miles run was 3172, and the number of tons carried 2475. After four months' working on a one-shift, on the removal of refuse in a congested area (three-quarters of a mile square), the success was so apparent that the committee decided unanimously to order a second machine.

Actual Running Costs.		Actual running cost. Per ton.	Per mile.
Capital charges on $4,866 for 10 years (interest calculated at 5% and sinking fund on 4% basis)	$510.44	$0.2038	$0.1590
Electrical energy at 3.55 units per mile, 11,250 units at 3c per unit	341.50	$0.1362	$0.1064
Oil and grease	5.62	$0.0024	$0.0018
Maintenance of chassis, body, batteries	.....	$0.0216	$0.0168
Maintenance of tires, assuming life of tires as 10,000 miles and costing $194	61.42	$0.0246	$0.0192
Insurance at $61.85 per annum	48.90	$0.0194	$0.0152
Driver at $10.82 per week	546.76	$0.1780	$0.1388
Total running cost	$1,466.84	$0.5860	$0.4572
Four lifters at $8.40 per week	1,392.00	$0.5566	$0.4342
Total cost of removal	$2,861.84	$1.1426	$0.8914

Mr. Thwaites states that both Messrs. Harrods and Messrs. Lyons have each a fleet of electrics, and he has gathered from their experience that the more intermittent the work the greater the saving. That was, indeed, natural from the experience of electric work generally, and he could also verify the statement by his own experience. He was compelled some six months ago, owing to the Government having commandeered 10 useful horses, to purchase two (2-ton Austin) cars to distribute ½cwt. bags of coal from door to door in the congested areas in question, and he expected the cost of delivery to be heavier than by horse. The experience was useful and worked out as follows:

ONE AUSTIN TWO-TON CAR.
One week, April 25 to April 28, inclusive.

Driver's wages	$10.92
Assistant	9.06
Insurance and garage	1.80
Interest on capital, $3,696 at 5 per cent.	3.51
Depreciation at 15 per cent.	9.84
Gasoline at 56c per gallon	16.98
Oil and grease	1.08
Repairs and renewals	8.46
Tires	9.18
Total cost	$69.83
Cost per ton, load of 92 tons, 2,240 pounds per ton	$0.76834
Previous cost, 92 tons, with horses	$0.74000

The saving is not worth considering either way, although great care was taken when entering a street to go to the top and brake down; but if he had been able to secure electrics the saving would have been pronounced. His committee will consider the change as soon as delivery of the cover-type Edisons are available. Electrics were too high in price, but no doubt they would cheapen considerably with the advent of normal times. Mr. Thwaites is very positive, however, that they stand alone on the work mentioned for simplicity and economy, apart from the economy question.

LINCOLN HIGHWAY'S NEW PRESIDENT.

F. A. Seiberling, President of the Goodyear Tire & Rubber Company, One of America's Big Men, Elected.

In the election of F. A. Seiberling as president of the Lincoln Highway Association, succeeding Henry B. Joy, who has entered the aviation section of the government service, one of America's big men, has been called to direct the affairs of the Lincoln Highway.

Mr. Seiberling is president of the Goodyear Tire & Rubber Company, Akron, Ohio, and brings to his new office a record of achievement that has few counterparts in American industry. After a varied business experience, he founded in 1898 the big rubber concern of which for 19 years he has been the active head, and which, with its $110,000,000 annual business, is a monument to his business and financial genius.

TRACTORS AND POWER.

Without a doubt the tractor can be made an electrical as well as oil or gasoline propelled machine. If the heaviest trucks are open to conviction then, this newest motor of the soil is also convertible.

From February 11 to February 16 a unique school was conducted in the Coliseum at the Fairgrounds, Columbus, O., called by Governor Cox to conserve man power and produce greater acreage this year than ever. No one man was more surprised to see the ready response to the appeal than the governor himself. More than fifteen hundred, mostly young men and ambitious, gave up the solid week at their own expense to inquire into the intricacies of the tractor as a farm necessity.

In order to encourage every honest and determined farmer to secure a motor-driven plow and harrow, at least a million dollars will be diverted from usual securities and devoted to the loans through small banks. The Federal Reserve Fund will back up the propaganda, though one bank will discount paper through another of greater assets. A cash payment will get the tractor to the farm and after that liberal payments, one, two or more years will be granted.

Specialists in agriculture and mechanics from the state universities and from public offices entered the unique seminary full of optimism and full of encouragement for the results which are sure to follow the larger use of motors and horseless power.

It is not style which is sought, neither is it looks, but horsepower pure and simple. The state does not attempt to dictate what make of machine shall be used, only that none be overestimated.

War times demand extraordinary precautions and achievements. The tractor is, according to the governor, the heavy ammunition at home. If two tons can be grown where one was grown before, it eases the market and makes possible a greater supply for foreign use.

Electric Vehicle a Factor in Transportation Engineering

Time Now Opportune for Encouraging Electric Vehicle Applications—Economies Deserve Wider Publicity—Many Succesful Operations

THIS time of year is somewhat of a transitory nature. Looking back upon the last winter, one recalls the salient facts—failures and successes—where apparatus and methods have failed, how they might have been prevented or modified, and the effect of modification upon revenue, safety, time and so forth. With the electric vehicle, both manufacturer, central station company and prospective buyer, should now, as the winter changes gradually into summer, consider the electric vehicle performance during the past months, and from this plan campaigns and policies to take advantage of past experience and existing conditions.

The electric vehicle has played a less prominent part in America than it has in Great Britain in the last year toward winning the war because we are farther removed from the strife of war. We are at the source of production of almost all the commodities used for waging war and maintaining life, whereas Great Britain is isolated from the source of production by several thousand miles of ocean, made difficult of travel by submarines and ship shortage. Nevertheless the reasons why the electric truck has found such strong and enthusiastic exponents in Great Britain, and why its use has multiplied so enormously within the last couple of years are, too, the underlying reasons for the success and desirability of the electric vehicle here. Scarcity of coal, high cost of gasoline, shortage of skilled labor to drive and, more important on score of operating costs, to maintain the gasoline engine and mechanism in good condition, and combined low operating costs are the reasons that have caused the electric to be used so widely in England as a means of winning the war.

Here the pressing problem has been one of transportation rather than of fuel, although the price of gasoline is very high with prospects of going higher But the underlying reason for the growth of electric vehicle usage and applications apart from all the other advantages that accrue to the nation and the public as in contrast to the owner of the electric is that of low operating costs.

Sign of the Times.

It is only of fairly recent date that transportation by road as well as rail has assumed the aspect of a real problem. Yet today the road transportation problem is a very serious one which affects vitally such matters as the high cost of living, the limitations of railroads to handle freight at their terminals, and the ability to keep in close touch and maintain quick intercourse between suburb and city, farmer and market, for the distribution and marketing of perishable produce.

The horse, inefficient, extravagant and unhealthy, is being replaced for bulk haulage by mechanically propelled vehicles. Co-ordinated and co-operative bulk distribution and trucking have already advanced to an accomplished fact in some of the more densely and actively populated and therefore more congested zones. Trolley and road vehicles are being used more than many realize for purposes of rapid transit of freight, the reduction of overloaded steam lines and terminals. The tendency is to eliminate human effort by mechanical, reduce handling to a minimum and discard needless delays in transit, by concerted means use equipment more efficiently and intensely, speed up rate of shipments, and lower costs.

Into the scheme of things the electric vehicle must play its part. When, is simply a matter of time. How long that time shall be delayed depends very largely upon the co-operation, wisdom and enthusiasm with which the electric vehicle is sponsored by manufacturer and central station, and with what vim these two work together toward a common goal. The demand for the electric vehicle already exists, is just beginning to exist, and thus the central station is

A Fleet of Electric Trucks Indicates Transportation Is Carried Out on Sound Business Principles.

Public Utilities Not Only Find the Electric Economical But a Good Advertisement as Well.

fortunate since it is not necessary to create a demand and foster a protege as has been necessary with more than one class of central-station load in the past.

It might be said that the larger the number of electrics in use within a given territory the simpler is it to sell more—provided the saturation point has not been reached. The greater the number of electrics the more numerous the charging stations, the more and convenient and complete the facilities for overhauling and maintenance, and the more efficient and inexpensive and universally useful will be the battery exchange system that comes into vogue.

Transportation a Business Proposition.

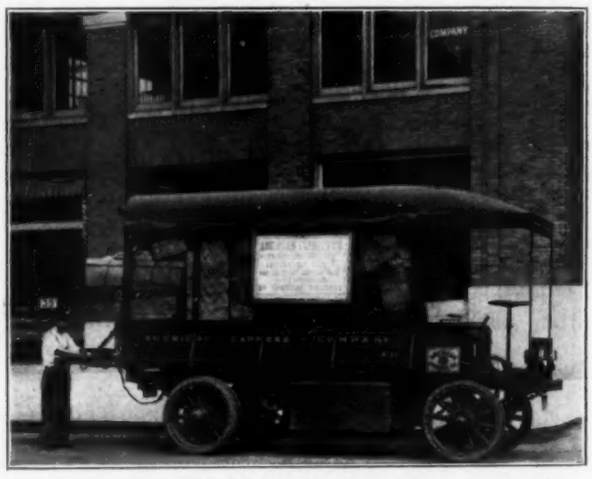
Perhaps there could be no better argument nor proof of the economy of the electric than to point out the repeat orders made by those who have placed their transportation problems upon a scientific basis, which means the application of sound business principles. The express companies, whose profits depend chiefly upon keeping down operating costs, would not employ hundreds of electric trucks, a number of these companies using several hundred, if it were not economical to do so. The department stores, some of which have nearly 500 trucks, whose delivery costs are the lowest of all classes of business, would not use these large fleets of delivery trucks if gasoline cars or horse-drawn vehicles were more economical.

The Electric Truck Adds to the Capacity of Freight Terminals and Lowers Cost of Freight Handling.

Unfortunately those business houses whose business embraces transportation, not as the main but merely an auxiliary undertaking, have not given transportation the same sound consideration that they have the remainder of their business. The result is too often inefficiency and needless expense, which eats into profits. This fact is becoming better realized, thanks largely to campaigns of education carried on by progressive central station companies, and today many of the larger bakeries, coal and ice dealers and others having to use transportation in some form or other are rapidly turning to the electric vehicle as the best way of reducing their transportation costs. That the cost of delivery is a real factor in the high cost of living has been brought out undeniably by a preliminary report of the Census Bureau. In this survey it was found that the cost of cartage one way in cities represents on an average 8 per cent of the total cost to the consumer. The actual cost varies with the different classes of business, of course. The cost of ice delivery was found to constitute about 45 per cent of total cost, that of coal and wood some 19 per cent, of milk and dairy products 12 per cent and for department stores less than 2 per cent.

Municipal Service.

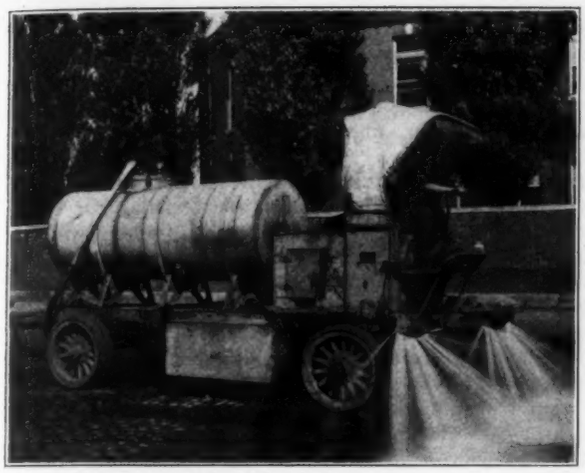
The use of the electric vehicle for municipal work is finding staunch exponents. While the number of trucks employed in this way is very extensive, this branch of transportation and civic efficiency is but in its infancy. Politics and civic management are undergoing a change, times are changing, and efficiency and economy are taking the place of corruption, waste and extravagance. The city manager idea, the movements for cities healthful and beautiful are having the effect of attracting atention to the electric for municipal work. In Great Britain even more rapid strides have recently been made than here in this respect because municipalities are there operated differently, economy has received greater attention, and economic conditions since the war have exerted a powerful influence on behalf of the electric for municipal service.



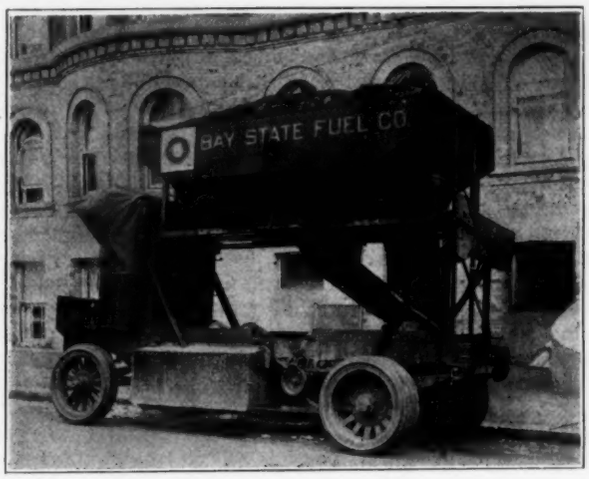
The Large Express Companies Soon Appreciated the Economy of the Electric Truck. Today There Are Many Fleets of Several Hundred Trucks Each in Service.

The method existing in many cities of contracting for teaming service for hauling, garbage removal, street cleaning and various other similar work is often of the most corrupt nature, being a means of political patronage. Many cities have already abolished this primitive, costly and unwise policy of private teaming by contract, replacing it with municipally-owned mechanically-propelled vehicles. Invariably large saving has been obtained for the taxpayers.

Street and sewer cleaning and flushing, lamp and tree trimming, garbage collection and disposal are some of the commoner uses of the electric vehicle for municipal service. The slow haul and routine work, such as hauling coal to heating plants and removing ashes, the circulation of books between libraries and similar work are other applications in which the silent efficient electric is finding enthusiastic users. For ambulance service the electric is ideal with its smooth acceleration, gentle control and easy running characteristics. Its ability to accelerate rapidly, far more rapidly than the gasoline vehicle, makes it very advantageous for turning and frequent starting and stopping in narrow and congested streets. This same characteristic is proving of great advantage not in civic



Characteristics of Performance and Control Make the Electric Vehicle Admirably Adapted for Many Municipal Purposes.



Electric Truck Used in Boston for Delivering Coal—Equipped With Special Body.

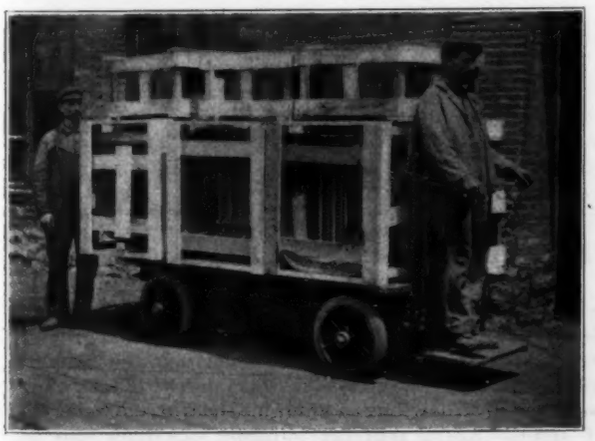
service alone, however, but with electric taxicabs and buses.

Coal, Ice and General Deliveries.

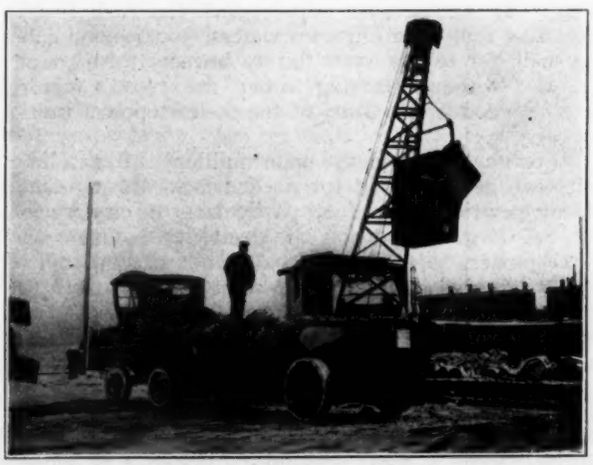
Coal delivery by electric truck proved itself invaluable during the last winter. The severity of the winter, the deep snow fall and the great demand for coal created a coal situation difficult to handle. Coal supplies soon became depleted and exhausted. While coal existed coal delivery was carried on strenuously, until stocks were depleted. The work was severe and under the strain horses broke down and gasoline cars failed. The electric excelled itself in a number of cases reported, both as regards tons of coal delivered and mileage. Some electrics delivered as many as 70 to 120 tons of coal in a nine-hour day, traveling more than 26 miles all told to do it. Numerous authentic cases have been reported where overloaded electrics outstayed gasoline cars, and got through ice and snow where horses would not venture and gasoline cars failed.

Ice delivery by electric truck, which has advanced particularly well in Chicago, offers interesting economies. With the electrically operated ice plant energy costs due the high load-factor off-peak ice load are low, hence additional energy for charging electrics metered through the same meter as the energy for the manufacture of ice reduces the cost of battery charging even more than under ordinary conditions of rates. The economies of electric delivery are, however, not due to this, for energy cost is but a small item in expense. With the electric more rapid deliveries can be made than with the heavy two-horse ice wagons, less ice is lost by shrinkage, fewer men are required, and, very important, the electric does not require to be supplied with energy except to make up for that actually used. In the ice business the demand is largely dependent upon the weather. On cold days and during cool summer spells the demand for ice drops suddenly. With the electric truck, these seasonal changes merely result in loss of revenue necessitating payment of interest upon idle investment for trucks and plant. With horses, on the other hand, it is necessary to feed them whether they work or not. Moreover, the demand for ice is erratic. The more intense the heat the greater the demand for ice and the greater the tonnage delivered per diem. The horse suffers in health and capacity for work during the hot weather, and thus fails when needed most. On the other hand the capacity of the storage battery increases as the temperature of the electrolyte increases.

So long as ice has to be delivered it matters not whether it is natural or artificial ice. Many companies deal in both ice and coal, the maximum demand of the one coming in the summer, that of the other in the winter. In cases of this kind the convertible electric truck opens up a wide field, for such a truck can then be made available for either ice or coal distribution according to the demand or season, in this way per-



Electric Trucks and Tractors Helping Conserve Man Power and Expedite Deliveries.



City Garbage Disposal Is Well Adapted to the Electric Truck.

mitting the investment in the trucks being utilized most efficiently. In Chicago one company is credited with using some twenty-five of these convertible trucks with entirely satisfactory results for nearly two years now.

While the electric vehicle for both commercial and pleasure purposes possesses many secondary advantages over the horse and gasoline vehicles such as silence, absence of odor, greater ease of control, less wear and tear on roads and so on, the final criterion is that of cost to the owner. It is on the basis of cost therefore that comparisons should, in the ordinary way, be made. Central-station companies and electric vehicle manufacturers are familiar with the costs of various modes of transportation varied for purposes. But it is necessary that the prospective user of a mechanically propelled vehicle also have the cost data brought to his attention. There is a feast of valuable information as to relative costs of operation of gasoline and electric truck, but this information circulates in too restricted channels. It should reach not only the immediate prospective purchaser but the ultimate purchaser. In other words, the advantages of the electric vehicle are not sufficiently made known. The electric vehicle has made good much too well to have its light hidden under the bushel of insufficient publicity.

ELECTRICITY AS A WAR FUEL.

"If, according to Dr. Burton, chemist of the Standard Oil Company, the 1917 production of gasoline will be 2,500,000,000 gallons, of which he estimates 2,000,000,000 gallons will be required for American automobiles, it follows that but 500,000,000 gallons will be available for use by military trucks and for export to the allies," says F. Nelson Carle, former secretary of the Motor Truck Club of America.

"With all due respect to so eminent an authority, I venture to raise the point that nearer 50 per cent of our next two years' production of gasoline will be required directly or indirectly for war purposes. Fortunately for the passenger car owner, other fuels are being adapted to the use of farm tractors and gas engines so these agricultural necessities will not compete with him for fuel as heretofore.

"But what about the submarine chaser, the gas-driven scout cruiser and the motor boat patrol? A good, big 'chaser' of the type now building, perhaps by the hundreds, certainly by the score, has two and in some cases three 250-horsepower motors which consume, in action, 30 gallons of gasoline per hour per motor. If we have to supply fuel for such boats abroad as well as in our own waters, 500,000,000 gallons will not supply such thirsty hornets throughout the war without starving either the 70,000 motor trucks needed by the army or the 60-horsepower touring car.

"Fortunately millions upon millions of gasoline units can be conserved for needed tasks through the use of electricity as a fuel, particularly in city trucking. A large proportion of electricity is made by water power, so that even coal is not needed to increase the supply of this fuel in some sections. Granted coal is used, the cost of industrial electricity is so low that it forms one of the cheapest means of propelling motor-driven city vehicles.

"The war practically denuded European cities of petrol vehicles in the first year of the conflict, and the relatively small number of commercial electrics then available were in great demand, particularly as horses had also been commandeered.

"Since that time the demand for electrics has been greatly augmented, resulting in a 600 per cent increase in England alone. The leading railroads—among them the Midland Railway, which has purchased over 100 electric trucks, many of them American built—have bought heavily. All over Great Britain the demand for electric lorries, and in fairness to all, for steam vehicles, too, is said to be greater than the supply. Gasoline (petrol) vehicles are still being built or imported in large quantities, but almost wholly for military purposes. The mortality among trucks pounding over the shell-shattered roads of France and Belgium is almost unbelievably high.

"Much the same situation obtains in France, Germany and Austria, the electric being given the preference in transporting mail and merchandise about the cities or between industrial centres. By its use gasoline is conserved and many wartime economies made possible, among these the utilization of women drivers.

"Even well informed business men do not always understand why electricity used for recharging truck batteries can be purchased for less than the electricity for an office building or residence. The reason is obvious if they will but consider the simplest of laws—commercial demand. When the business day begins factories, stores, elevators and other units make their requisition upon the 'central station,' as the main plant of the electric light company is called, and by 11:45 a. m. the load has reached a tremendous peak.

"During a short sunlight day, as in December, the demand upon the central station around 5 p. m. is frequently about all the machines that make the energy can stand. There is a small 'valley' during the noon hour, but, generally speaking, all the current manufactured during the day is consumed. Naturally any one adding to the 'day load' as it is called, should almost pay a premium for his current.

"But at night all this is changed. Then many of the big generators are idle, others producing but half their capacity. By midnight a few residences, hotels and electric signs are all that is left to consume current. During the 'off peak' hours, then, say from 7 until 7, the central station is hungry for business and the man with an electric truck or a fleet of them with depleted batteries is as welcome as the proverbial spring flowers.

"Then is when he can buy electricity for as low as one-third of what he might pay during the peak hours of current demand. So low is this rate in many cities, including Boston, that sufficient current to keep a 5-ton electric truck running all day can be purchased for what it costs to buy four gallons of gasoline, or to feed a single horse for 24 hours.

"From the standpoint of motor trucking, then, electricity would seem to be the logical fuel for such trucks as confine their activities largely to the city and immediate suburbs. Intelligent conservation of petroleum and its derivatives is as important as that of grains and other products of the soil."

VEHICLE POWER FOR SUCTION CLEANER.

Any live contractor or private owner of an electric vehicle can reap a harvest by obtaining a vacuum cleaner of proper voltage, and operating it from the vehicle battery by a long extension cable. It overcomes the housekeeper's oft-encountered fear that your portable machine is running the current bills out of sight. Noisy portable gasoline machines are no competition for this sort of combination. It works successfully and is good for 25 cents per hour.

INTERESTING FEATURES OF AN ELECTRIC VEHICLE OF 1898.

Comparisons with Present Vehicles Indicate that Rapid Progress Has Been Made.

By J. G. Mitchell.

The electric automobile has very little in common with the pioneers of its class. Not only has the entire body design been revolutionized as a result of 20 years' experience, but the uses to which it was hoped the vehicle might be put have been found to exceed the inventor's rosiest dreams. In fact, the original inventors of the electric automobile would hardly deem the most extravagant claims made for it commensurate with the daily experience of today.

One of the most promising models produced in the late nineties was the two-passenger stanhope illustrated in Fig. 1. This car was equipped with solid tires about 2 inches wide next to rim and about 2½ inches thick. It carried 40 cells of storage battery in four trays of 10 cells each. It must be remembered that the automobile storage battery itself, at that time, was far from its present stage of perfection. The cells used weighed approximately 21 pounds each or about 875 pounds for the set, ready for use, in its four wood trays. This battery had an ampere-hour capacity of about 160 at a normal discharge rate of 20 amperes. The car, without passengers, weighed about 2700 pounds.

At the normal running speed, on level asphalt about 12 miles per hour, the current demanded by the motor averaged 18 amperes. The controller was arranged to give three speeds, both forward and reversed. They were obtained by connecting all the four trays in parallel, first speed 20 volts, then two trays in series and the two sets of trays in parallel, second speed 40 volts; then all four trays in series, third speed 80 volts. With this arrangement it was necessary to make use of a straight series motor which was reliable and "on the job" all the time, but which was not as economical as some form of compound-

Electric Vehicle of 1898.

wound motor would have been on the running speed. When a "burst of speed," 25 miles per hour, was to be made, the field winding of the motor was shunted with a small adjustable rheostat. The contact arm that controlled this shunt was placed at the bottom of the carriage dash and was operated by the driver's toe. As the lever was moved to one side the resistance in the field shunt was reduced and the speed of the car increased, with a seriously increased drag on the battery, until the practical limit of about 25 miles per hour on level asphalt had been reached.

The steering lever shown was also the speed-control lever. When swung in a horizontal plane it moved the steering wheels just like the old "toboggan" type Olds gas cars. When moved in a vertical plane it operated the controller, and when brought sharply upward against its stop it operated the service brake. This arrangement was a very convenient one and driving the car became almost involuntary in a short time. When it was desirable to stop short, the very act of expressing that desire in a gesture was apt, by raising the steering lever, to stop the motor and set the brake. As the steering lever was forced downward it operated the controller drum, establishing the proper battery circuit arrangements for successive speeds. Each running position of the controller was identified, to the driver, through the steering lever by a series of very perceptible spring engagements in notches, one for each speed.

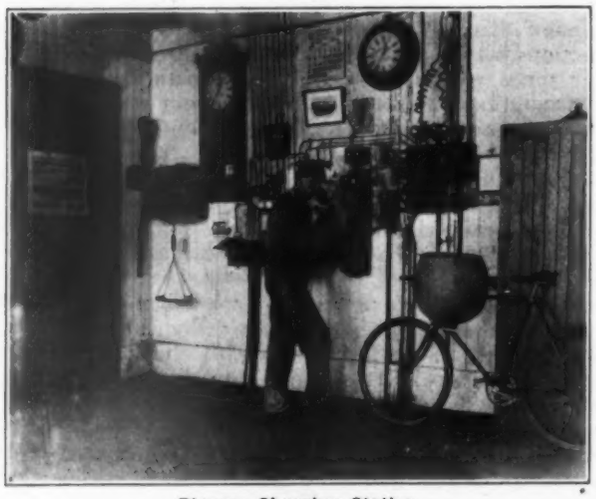
The small nickeled arrow-shaped lever seen at the top of the steering head just below the forward end of the steering lever operated the reverse drum of the controller. When turned so that it pointed forward. it was locked in place and the car would move forward. When turned to point to the rear the car was reversed. When turned to point upward the motor circuit was open, the car could not be started, and the reverse lever could be removed and retained as a means of locking the car.

The hill-climbing qualities of this car, owing to battery conditions, were somewhat dubious. In other words, the traction required when the going was heavy increased the current demand of the series motor to a point that occasionally brought disaster to the connections between the cells in the trays. To reduce the car speed with a corresponding reduction in current consumption for this class of emergency going a back gear was rigged between the motor and the differential. This back gear was similar to that found on engine lathes. When the car was in back gear there was a double reduction between the motor and intermediate gear shaft and between the intermediate and the differential. Originally this back gear arrangement was designed to be operated by a system of levers controlled by a "pull up" spade handle in front of and below the driver's place. The author has a lively recollection of attempting to change the gear after essaying a certain grade and becoming stalled midway. The service brake was tied to the *intermediate shaft*. The emergency brake was not very efficient and operated on the rear tires, through a foot pedal, by means of ordinary brake shoes. When the attempt was made to shift gears on the grade, the emergency brake was set to hold the car, while the intermediate shaft and the service brake were momentarily out of gear. The emergency brake failed to hold and the gear could not be re-engaged either in direct or in the back gear. After strenuous effort it was realized that the car could not be arrested and the trip down hill was made backward at a speed much greater than was consistent with comfort. Needless to say, the point of application of the service brake was changed as soon as possible and the design modified accordingly.

In the floor of the car was placed the foot pedal to operate the emergency brake. This pedal was also a knife switch in the main motor circuit so that when the foot brake was set the motor was also stopped.

It was necessary to throw this pedal and leave the motor circuit open when charging, as the charging was done through the running contacts of the controller. This also caused occasional trouble as a careless attendant might, and did occasionally stroll along and release the foot brake detent when the charging current was flowing. The proverbial "bull in a china shop" was a peaceful dream compared to a driverless electric automobile with both the reserve capacity of the central station and the capacity of its own battery behind the motor.

One of the interesting features of the development of this car was the storage battery. It was necessary to do pioneer work in many ways and the points worked out experimentally are surprising in view of present established practice. At first the individual cells of the battery were connected together by means of short lead straps *bolted* at each end to the terminals of the cells. For making this connection, lead covered bolts were used. This was found, as we know now it was sure to be, to give trouble owing to the impairment of the contact due to vibration of the car. When once the contact was impaired, the passage of the current through it completed the ruin. The cells were then joined together by lead strips "burned" to each cell terminal. This was a great improvement but the first connecting lead strips were made too light and were soon crystallized and broken. It was found that the wood trays could not be made to retain the heavy individual cells in place tight enough to prevent considerable vibration. When the straps used for joining the cells were made heavy and were also made short and "burned" to the cell terminals, the trouble was arrested. In this case the straps not only connected the cells electrically but held them rigidly together mechanically, reducing weaving to and fro and practically eliminating breakage. When the light straps between cells were used it was a common experience of the author to fuse one of them when the going was hard. The driver always carried some bare copper wire in the tool box of the car in order to be able, when occasion demanded, to join them together again, after an experience of this sort, and get home.



Pioneer Charging Station.

The stanhope shown was deemed very cosy and comfortable. Compare it with the present electric car design. In rainy weather it was necessary to put a waterproof curtain over the lap of the driver and passenger, *à* la country doctor gig, in order to keep dry. The car that would be considered a joke now, however, was the pioneer of its class and many of the problems that had to be solved were worked out in cars similar to the one shown in the cut. The date of the photographs is about 1898.

HELP SOLVE THE TRANSPORTATION PROBLEM.

Concrete Suggestions to Shippers by the National Organization of Business Papers.

The growing menace of the freight transportation situation has induced the Associated Business Papers, Inc., New York, through their Executive Committee, to formulate a plan for definite, practical co-operation by shippers to relieve terminal congestion and keep freight moving.

The following plan calls for action, now, and shippers everywhere are urged to bring it to the attention of the proper organizations for that purpose.

To win this war we must do things. Do them quickly, with less labor and less waste. We must increase valuable activity and decrease wasteful activity. We are at present suffering from a decrease of activity all along the line. This decrease comes from the inadequacy of the distribution system. It is time for the producer of raw material, the manufacturer, the warehouseman, the jobber and the dealer to understand that distribution, the movement of materials from the point of production to the point of fabrication and the movement of goods from the point of fabrication to the point of consumption, is the foundation of all industrial endeavor.

Government Needs Your Co-operation.

Neither the efficient control of government bodies nor the wisdom of the railroad men can solve the whole problem. A large part of the difficulty is the local and short haul difficulty, resulting in congestion which extends back into the main arteries of transportation. It is time for the business man in all lines of endeavor to realize that he is not merely a buyer of transportation, at a price per mile or per ton, but that adequate transportation service is absolutely necessary to the profits of his business. At the present time the interest charges on goods in transit frequently amount to very much more than double the cost of transportation, while the cost of waste, due to inability to secure materials and ship goods, runs into much larger figures.

For these reasons all men who secure their livelihood from the production of materials or goods and the sale of those products should be interested in pushing for these items, which will enable us to build up an adequate transportation system.

The government has now assumed control of the railroads, and Director General McAdoo has surrounded himself with an able staff of practical and successful railroad operators. A National Highway Committee has been appointed, with Roy D. Chapin, president of the Hudson Motor Car Company, as its head, and the Board of National Waterways Association is working with the official committee on this problem. Under these circumstances, and having in mind that we have not in our industries displayed any well-organized efforts to aid in the solution of the traffic problem, it is our recommendation that the matter will be best served by our full co-operation with these governmental bodies. It is time to quit

kicking about rules which are established in the endeavor to clean up the situation and to co-operate in such a whole-hearted and intelligent way that the tangle of transportation difficulty may be more rapidly untied and the situation cleared in record time.

It is recommended for this reason that, generally speaking, the shipper should be urged to foster movements in the following directions:

FOR THE IMPROVEMENT OF RAILROAD SERVICE.

1. The provision of adequate rules to secure the full efficiency of transportation service.
2. This includes establishing proper charges for freight and demurrage and the enforcement of equitable rules for loading and unloading, shipping and packing.

FOR THE HIGHWAYS.

1. The extension of paved highways.
2. Provision for keeping these highways open at all seasons.
3. Proper provision for the maintenance of these highways.

FOR THE WATERWAYS.

1. The construction of barges and small towboats to provide for the adequate use of existing highways.
2. Provision for putting into shape existing waterways that have been allowed to become obsolete.
3. Provision for the wise extension of these waterways to correlate with the railroad system.

As a measure of relief from the present congestion, it is recommended that the shipper be advised that he can materially aid himself in the improvement of his own transportation conditions and the elimination of the excessive costs of not being able to do business by carrying out the following suggestions:

IN CONNECTION WITH THE RAILROADS.

1. Co-operate and put it over. Do not kick at changes.
2. Load and unload promptly. Do not wait for a convenient season.
3. Load to capacity.
4. Do not reconsign en route. Decide the destination before the goods leave.
5. Pack securely and mark plainly.

IN CONNECTION WITH THE HIGHWAYS.

1. Make a survey of all the incoming and outgoing freight handled within zones of 10, 25, 50 or 75 miles from your city.
2. Ship all goods to be delivered within the above zones over the road by motor trucks.
3. Demand that all goods to be shipped to merchants in your city and originating within the zones mentioned be delivered by motor trucks.
4. Make a census of all motor trucks in your town available for this work.
5. Take up with your local offices of the national express companies and your local haulage and express concerns as to how far they can extend their present delivery routes.
6. Select a committee of the best traffic managers of the concerns in your city to lay out a detailed plan to suit your own local conditions and determine upon the fair rates to be charged.
7. Arrange for a sufficient number of receiving platforms or warehouses where you can use horse wagons and motor trucks up to 3-ton capacity to deliver and set down goods, leaving for the larger trucks the running between the main points in the zones. Do not try to make the trucks running overland between the main points do pick-ups and deliveries. It cuts down their efficiency and makes the maintenance of schedules impossible.
8. Put some trucks in the overland haul work on definite leaving schedules, so that goods can be delivered to the receiving platforms or warehouses in time to make up full loads to any given points.
9. Arrange a Return Loads Bureau. Arrange with the local telephone companies to give your regular telephone number to any inquirer calling up and asking for Return Loads Bureau. Post notices in the offices of all of your merchants that you have established a Return Loads Bureau. Post similar notices in conspicuous places in the smaller towns and cities through which trucks running to or from your city will have to pass. This will enable your trucks and those of private truck contractors doing this kind of haulage and entering your city to quickly collect loads to be transported to their home cities.
10. Bring all pressure to bear upon your mayor and the governor and thence to your highway commissioners to keep all the main highways leading out of your city open during the remaining winter months.
11. Bring all pressure to bear on the proper authorities toward the resumption of the construction of main line highways at the earliest possible moment this spring and for a proper maintenance of the roads all year around.

IN CONNECTION WITH WATERWAYS.

1. Secure information upon transportation available on existing waterways covering short hauls.
2. Get behind the movement for immediate production of barges for the large canals, such as the Erie barge canal, which would relieve the freight situation between the lakes, coal regions and the important centers on the Atlantic seaboard.
3. Take up with the traffic manager of your business and the traffic expert of the local chamber of commerce the possibility of the use of waterways for any part of your freight movement and arrange shipping plans accordingly.

GEAR MAKERS TO DISCUSS STANDARDIZATION.

"Gear Standardization" will be the principal subject of discussion at the second annual convention of the American Gear Manufacturers' Association, to be held at Green Brier Hotel, White Sulphur Springs, W. Va., on April 18, 19 and 20.

The convention will begin with meetings of committees on Thursday morning, April 18. At 1:30 the first session will open with an address by President F. W. Sinram, "The A. G.-M. A.—Past, Present and Future." Following the address by the Chamber of Commerce representative, C. R. Poole will talk on "Hardening and Heat Treating of Gears," and B. F. Waterman will present the report of the Standardization Committee.

Friday morning's session will include reports of officers and committees, election of nine members of the executive committee and miscellaneous business. An informal banquet will be held in the evening.

On Saturday morning a paper on "Uniform Cost Accounting" will be presented by J. H. Dunn and on "Hobs and Hobbing Machines" by a representative of the Barber-Coleman Company.

New Appliances

Cutter Projectors—Half Shade—Standard Receptacles—Control Set—Float Switch—Vacuum Cleaners—Trico Fuse

NEW CUTTER FLOOD-LIGHTING PROJECTOR.

A new flood-lighting projector, designed for use of 300 to 1000-watt standard Mazda "C" lamps, has been placed on the market by the George Cutter Company, South Bend, Ind. It is called the "Standard" flood-lighting projector.

The new unit has the same general construction features as the Cutter "Universal" projector for flood-lighting lamps and which have made the latter unit popular because of its adaptability for the many purposes for which flood-lighting projectors can be used. These features include weather and fumeproof body or housing cast of aluminum or gray iron and forming absolute protection for the lamp and reflector; method of mounting that permits of the projection of light in any direction in any plane; construction of the housing that permits of the interchange of narrow or wide-angle-beam reflectors; sectional wire-glass doors to minimize breakage.

In the new "Standard" projector the socket is adjustable both horizontally and vertically for focusing the lamp or changing the width of the beam; when adjustment is made the socket is locked in position. Reflectors are made of copper, heavily silver-plated and finished with a coat of water and fumeproof lacquer. The narrow-beam reflector has a divergence

New Cutter Flood-Lighting Projector for Standard Mazda "C" Lamps.

of 10 degrees and the wide-angle-beam reflector a divergence of 30 degrees. They are designed to redirect the maximum amount of light from the lamp. Ventilation is provided by the hood of this projector.

METAL HALF-CONE SHADE FOR LAMP GUARDS.

In working about intricate machinery it is very often necessary to inspect machine parts or the work passing through, especially when trouble develops or the work snarls up. Cases where this is particularly true are in connection with textile looms, large printing presses, telephone-cable-making machines, etc. To make such an inspection requires a good inspection lamp that is guarded against lamp breakage and provided with a reflector that at the same time shields the eyes of the workman and throws the light into the part where the trouble has developed.

A half-cone metal shade to be used with a lamp guard for just such service has been placed on the

McGill Half-Cone Shade for Loxon Lamp Guard.

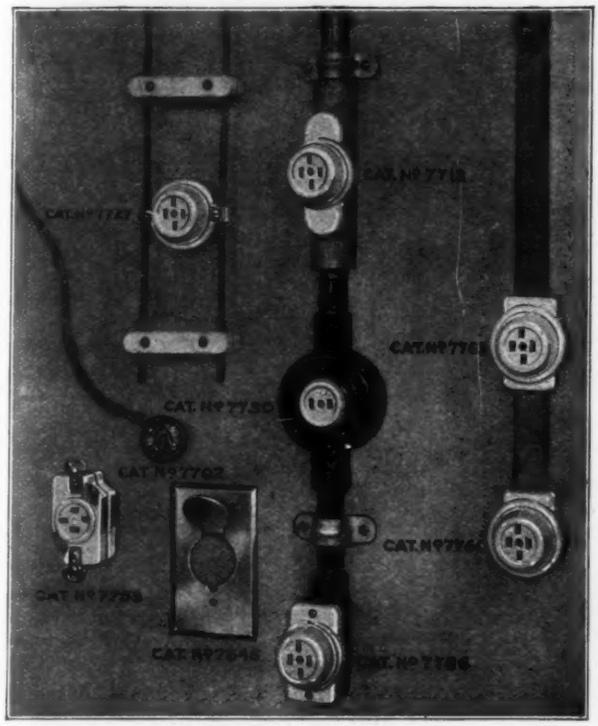
market by the McGill Manufacturing Company, Valparaiso, Ind. It was designed to meet the requirements of weavers, but serves admirably for all similar close work. The illustration shows it applied to a McGill Loxon guard, the combination making an extremely useful adjunct in the lighting equipment line. The shade has a dark green exterior and matt aluminum reflecting surface. It is made for use with 25, 40 or 60-watt lamps and brass-shell sockets.

NEW "STANDARD" RECEPTACLES.

The new additions to the line of "standard" receptacles, made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., were designed with the idea of providing a "standard" receptacle for the more popular forms of conduit fittings, as well as for metal molding and for cleat work. The accompanying illustration shows how easily these receptacles can be used with the various fittings. Receptacle No. 7753 is intended for use with flush plates having a hinged lid. Nos. 7760 (one-way base) and 7763 (two-way base) are for metal molding. Receptacle No. 7730 can be used in a Condulet as shown or with round Unilets, or any outlet box having sufficient depth and suitable cover. No. 7766 fits both ½ and ¾-inch Paiste Taplets and No. 7713 is for ½-inch obround Condulets.

The receptacle for cleat work (No. 7727) has proven very popular where open wiring is permitted It can be readily slipped under conductors supported by cleats and provides an additional outlet for any appliance. These receptacles are of two-piece construction, held together with one screw and nut. Be-

sides being small and neat in appearance, liberal provision has been made for entrance of the wires and they are very easily wired. Riveted construction is used to contact clips, thus insuring against loosening, as often happens when screws are used. The C-H



Some of the Many Ways of Using C-H Standard Receptacles.

"standard" straight-pull attaching cap shown in the illustration is interchangeable on all C-H standard plugs and similar standard caps and receptacles of six other manufacturers. This interchangeability is very desirable in the factory or home where electrically operated devices equipped with various attaching caps are many times connected to plugs and receptacles furnished by several different manufacturers.

A NEW AUTOMATIC SPEED CONTROL FOR SUGAR "CENTRALS."

To maintain the given relative speed from roll to roll in sugar "centrals" and to vary the speed of the crushing rolls as a whole without changing the predetermined relative speeds, the General Electric Company has developed a new system of electric drive and control for cane-crushing rolls. The pioneer equipment is being installed in Central Cunagua, Cuba.

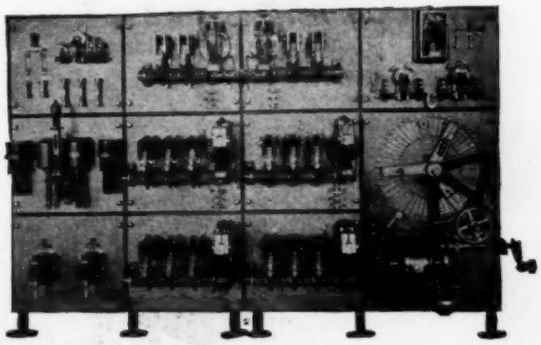
As the cane feed varies, the torque of the motors will also vary, and a means was therefore necessary to maintain a given speed independent of the load. To gain these results this control was developed.

Previous practice utilized variable-speed induction motors with manual speed control, through the adjustment of the secondary motor resistance, to obtain relative speed control and to reduce the output of the whole mill. With the variation in torque experienced it was found difficult to maintain a given relative speed, and when it was desired to operate at reduced output it was found that the motors required the same power input. Since, however, by reason of the small quantity going through the rolls the refuse cane constituting the fuel was reduced, in order to maintain power it was necessary to make up the deficiency with wood or coal.

The new system provides for automatic control for the relative speed adjustments and a variable-speed steam turbogenerator to give reduced output of the mill. Each motor is served from an individual control panel which contains electrically operated switches for regulating the speed of the motor. Master controllers which control the motors through the panels are grouped at a convenient point on the mill platform and give the operator complete control of the motors, excepting that the general speed changes of the mill are made at the turbine governors. The several motors driving the individual rolls comprising a mill or tandem are operated from a turbine independent of the sugar house and speed changes of the mill will not therefore affect the normal operation of the motor-driven pumps and miscellaneous drives.

On the shaft of each motor is mounted a direct-current magneto-type generator which excites the magnet coil of a balanced relay. Contact points on this relay operate a pilot motor which moves the contact arms of a dial switch and thereby varies the resistance in the motor secondary. As the torque on the motor varies, the speed will vary, and thus the change in the voltage of the magneto generator will vary the pull on the arm of the relay and start the pilot motor up in a direction to change the amount of secondary motor resistance to restore the motor speed. A resistance in the magneto generator circuit regulated by the master controllers will provide means for adjustment of the motor speed.

A change in the speed of the tandem changes the speed of the magneto generators as well, and would ordinarily affect the balance of the relays. Here a rather ingenious idea is used to cause the speed governors to readjust themselves to a change in synchronous speed. The turbine generator is operated at constant excitation with changes in speed. The voltage will, therefore, be in proportion to the frequency. The magnet coil of the relay, which is excited from the direct-current magneto generator, is balanced by a coil excited from the alternating-current power cir-



Contactor Panel for Controlling Speed of a Sugar-Mill Induction Motor by Means of Balanced Voltage Relay and Motor-Operated Rheostat.

cuit. The change in synchronous speed of the motors will therefore cause a proportionate change in both the direct-current and alternating-current coils of the relay and thereby preserve the balance. The same relative speeds are therefore maintained from roll to roll when the speed of the whole mill is changed.

The automatic control panel provides for one point forward and one point reverse to 75 per cent speed with automatic acceleration, two points forward giving 80 and 85 per cent by manual control, and ten points from 85 per cent to normal load speed with automatic speed governor. Automatic control is also included for the two points of manual control and the master control can be quickly brought to any desired operating point without overloading the motor. While a range in relative speed is provided up to 15 per cent with normal load torque, it is not expected that all the motors will operate at the same time over this range.

Operation of the whole mill over a range of 30 per cent is done efficiently by means of a change in the turbine generator speed. If the excitation of an alternating-current generator is maintained constant and the speed varied, the voltage and frequency will vary approximately with the speed. An induction motor operating at constant torque from such a generator will draw approximately the same current at different frequencies, and the power input will vary approximately as the speed. The power requirements of the mill are therefore in proportion to the fuel delivered by the mill and additional fuel is therefore not required.

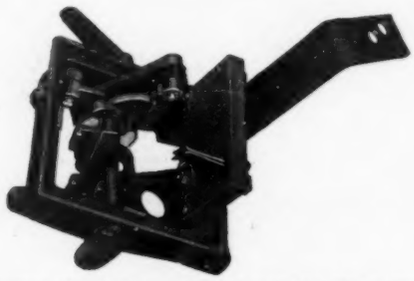
AN INCLOSED FLOAT SWITCH.

Anyone familiar with installations of remote-controlled pumps, such as pumps in the basements of buildings and tank pumps along railroad rights of way, knows that the pumps and motors receive very little attention, and the float switch still less, when the motors are started and stopped by such a device. As long as the water gauge shows a good supply of water in the railway tank the attendant will not trouble himself to know whether the float switch is covered with ice and dirt or whether the operating mechanism of the switch can operate properly. Overflowing of water tanks is not an uncommon occurrence.

Realizing the lack of attention given to float switches and the severe conditions under which they must operate, the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has developed an inclosed weatherproof float switch built so heavily it will stand lots of abuse and with an operating mechanism that will positively open and close with the rise and fall of the float. One of the chief objections to some switches is that they get out of step, if for any reason the switch fails to latch in. This happens through the contacts becoming badly burned, which prevents the blade from entering the clips, or where the blades become bent out of adjustment the same result follows. When the latching mechanism of such a switch gets out of step, the switch opens when it should close, and vice versa. The design of the new C-H switches makes this impossible. The switch can only be open when the lever is in one position and only closed when in the opposite position.

Cutler-Hammer Inclosed Float Switch Arranged for Wall Mounting.

A cast-iron case provided with mounting ears carries all of the operating machanism and terminals. A hole is tapped and bushed in the top of this case for the entrance of conduit. This arrangement permits removing the lower inclosure without disturbing the operating mechanism or connections.



Operating Mechanism of C-H Inclosed Float Switch.

The new operating mechanism consists of a cam and roller. The arm carrying the roller is pinned to the main shaft, which is turned by the outside cast-iron lever. The cam is made of malleable iron and is cast integral with the sleeve carrying the switch blades. This sleeve turns on the main shaft. When the main shaft is rotated, the roller is driven up the side of the cam, tightening an elliptical spring. When the roller passes the point of the cam, the tension of the spring either opens or closes the switch. This is the positive part of the mechanism, as the switch will always be open when the roller is on one side of the cam and always closed when on the other side. In addition to the action of the roller and spring, a direct pushout is provided through an auxiliary lever which communicates the motion of the main shaft directly to the cast sleeve, carrying the blades and pushes the blades clear of the switch clips. Under normal operation this pushout is not required, but it becomes effective should the switch tend to stick.

These switches are furnished complete with a sheet-copper float having conical ends, float rod, and a heavy float-rod guide. Conical end construction is used on the copper floats to give greater strength than flat ends and to lessen chance of the float opening at the end seams. Various mounting and controlling arrangements are furnished. The single-pole switches are intended for use in connection with a starter for controlling alternating-current or direct-current motors. The two, three and four-pole float switches are designed for single-phase self-starting and polyphase squirrel-cage motors, which may be thrown directly across the line to start. They can also be used for direct-current motors when used with a suitable self-starter. These multi-pole switches have a maximum capacity of 5 horsepower at 110 volts and 7.5 horsepower at 220, 440 or 550 volts.

DEVELOPMENTS IN VACUUM CLEANERS.

Descriptions of Representative Types of Cleaners with Particular Reference to Improved Designs.

The motor-driven vacuum cleaner has been on the market something over 10 years, during which time it has had a steadily increasing application. The ripened experience gained through these years has perfected the machine in many details which at first were naturally crude. It has also given opportunity for the development of new models embodying features of value.

The last year or so no very radical changes have been made in cleaner design and construction aside from such as have been necessitated by the scarcity and high cost of materials, which in a few cases has led to slight changes in construction details without affecting the value of the machine. In the following series of descriptive articles are given accounts of a number of developments by leading manufacturers of vacuum cleaners. No attempt has been made to more than state the claims made by the respective makers.

Hotpoint Division, Edison Electric Appliance Company, Inc.

This organization long known as the Hotpoint Electric Heating Company, Ontario, Cal., has been making two models of Hotpoint cleaners. Model L is made of pressed steel, is light in weight, yet strong and durable. The suction chamber and all parts over which the dust passes are made absolutely smooth and free from obstruction so that no dust or dirt can lodge on the inner surface. The exterior is finished in highly polished nickel over a heavy plating of copper.

Hotpoint Cleaner, Model L.

Hotpoint Model M.

This model is provided with an air-cooled motor taking 160 to 170 watts. It has an oiling system that allows no oil to drop on the floor coverings. The rear caster swivels so as to permit ready change in direction of travel of the cleaner without lifting. The switch is placed close to the handgrip at the end of the handle. The floor wheels are rubber-tired. A connecting cord 18 feet long is provided.

Model M Hotpoint cleaner is identical in general features with the Model L described above, but has the casing made of cast aluminum and the motor is mounted horizontally. This model is provided with a gear-driven floor brush in the nozzle which is connected with the floor wheels.

The Regina Company.

The Regina cleaner made by the Regina Company, of New York and Chicago, is made in two principal models, of which Model L is similar in design and appearance to Model K, but is operated by a larger and more powerful motor. These cleaners include a revolving brush inside the nozzle, this brush being operated through a set of gears inclosed in a dustproof gearcase. The body of the cleaner is made largely of aluminum, giving lightness in weight and easy manipulation. The nozzle is 12 inches wide and is so designed as to operate effectively in corners and close to baseboards. It can also be used for cleaning stair carpets. The extreme height of the cleaner is only 6⅞ inches above the floor. The oiling system is arranged so as to require oiling only once in a few months.

Hurley Machine Company.

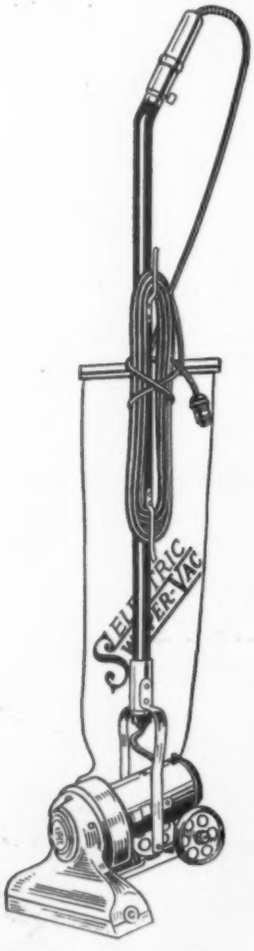
The Thor cleaners made by the Hurley Machine Company, Chicago, Ill., are of sturdy design and construction. The one illustrated is known as the Thor No. 5. It has a steel body welded into one piece. The nozzle is nine inches wide and contains a rubber comb for picking up hair, threads, ravelings, etc. This brush is easily adjusted up or down as desired. A swiveling caster supports rear of machine so it may instantly be turned in any direction. Total weight is only slightly over eight pounds. Hose for special tools is attached by merely removing the round metal cap over the word Thor above the nozzle and inserting the hose end, which cuts off the suction from the nozzle and concentrates it in the hose and tools attached thereto.

Thor Electric Cleaner No. 5.

The Thor model No. 12 is similar in general design to the No. 5, but has a 12-inch nozzle and a rubber bumper in front. It is intended for use in larger homes, apartments, hotels, etc., where a more powerful cleaner is required.

Pneuvac Company.

What is known as the Electric Sweeper-Vac is made by the Pneuvac Company, Worcester, Mass. This machine is light in weight and has a nozzle resting directly on the rug or carpet being cleaned. It has a self-cleaning motor-driven brush connected to the motor by means of a wormgear drive and belt inclosed to protect it from pins and dirt. The motor is balanced by having the fan at one end of the shaft and the brush drive at the other end. The brush can be instantly started and stopped by means of a switch located on the motor; this permits cutting out the brush when the hose is attached to the cleaner for use with portable tools so that the full power of the motor can be used for suction. A simple oiling system that needs attention only once a month is provided. The rear of the machine is supported by wheels instead of a caster. By means of a little finger on the side of the handle fork, the nozzle can be tilted upward to help clean slippery rugs. This cleaner is said to have a high vacuum and, combined with the brush, an exceptional cleaning efficiency.



Electric Sweeper-Vac.

Birtman Electric Company.

The "Bee" vacuum cleaner is made by the Birtman Electric Company, Chicago, Ill. It has a single-piece cast aluminum casing with swiveling rear caster. The nozzle contains a gear-driven revolving brush connected with two rubber-tired supporting wheels. The driving motor is one-sixth horsepower, air-cooled, and runs at 9200 to 9300 revolutions per minute. This high speed of the fan produces a very strong suction. Oblong carbon brushes are used on the motor armature to give abundant contact surface and prevent wrong insertion. A large hose connection leading directly into the center of the fan is obtained by swinging the name plate to one side. Every part of the machine is carefully adjusted at the factory so as to require no further adjustment.

Bee Electric Vacuum Cleaner.

The Torrington Company, National Sweeper Division.

Two types of electric vacuum cleaners are made by The Torrington Company, National Sweeper Division, of Torrington, Conn., and Worcester, Mass. The Torrington Electric Vac is illustrated herewith. It has a horizontal universal air-cooled motor driving the suction fan at very high speed. The nozzle is nickel-steel and contains a revolving brush with three rows of bristle tufts for sweeping up the incrusted surface dirt, lint, etc. This brush is easily removed and is positively driven to revolve in the opposite direction to the movement of the cleaner. The front wheel bearings are just back of the nozzle.

Torrington Electric Vac.

The company's Aladdin electric cleaner is of same general design but has not the same refinements of construction, thus making it a somewhat lower priced machine.

The P. A. Geier Company.

The Royal electric suction cleaner is made by the P. A. Geier Company, Cleveland, Ohio, and is claimed by the manufacturer to possess a number of distinctive features. Special care is taken in producing a per-

fectly balanced fan. This is a solid aluminum casting operating at high speed and giving what has been found to be an unusually high suction. The motor operates at a speed of 9000 revolutions a minute, which, together with the design of the fan, accounts for the high suction that has been demonstrated in numerous tests. The motor armature and fan are supported by extra large phosphor-bronze bearings immersed in oil so as to require oiling only about every three months. The nozzle is designed to clean under radiators and low furniture. It is 14 inches wide and is provided with a simple adjustment for regulating its height for the carpet or rug being cleaned so as to adapt it to the requirements of the particular weave. A stationary brush is provided in the nozzle that is readily detached. The dust bag is of special construction, very quickly detached and shaken out. To remove the suction nozzle and replace it with the hose connection requires merely the pressing of a button and makes a perfect connection without loss of suction when the hose is used. The handle is of high-grade steel tubing, finished in nickel plating. When the hose and separate cleaning utensils are used the handle is employed as an extension piece. In this case the bag support holds the bag in place. The cleaner is also easily convertible into a blower for certain purposes where the dust cannot be removed in any other way.

Kent Vacuum Cleaner Company, Inc.

The Vacuna cleaner, manufactured by the Kent Vacuum Cleaner Company, Inc., Rome, N. Y., uses the turbine principle to insure a constant flow of air, thereby maintaining the suction pressure at practically the same value whether the opening of the cleaning tube is closed by contact with the surface to be cleaned

Kent Portable Cleaner.

Kent Semi-portable Cleaner.

or whether it is free. On this account the makers state that the Vacuna has the ability to pick up every article and at the same time not exert a strong enough suction to injure the fabric being cleaned. The turbine operates at very high speed and is carefully balanced so as to run steadily without vibration. Westinghouse universal motors are used; this motor is designed on the principle used in the manufacture of very large motors such as used in railway work and is of the concentric compensating type which insures very long brush and commutator life. Variation of speed at the same load between direct and alternating-current service is very small.

The Kent company manufactures the small portable machine shown, which is intended to be wheeled over the carpets and rugs; the semi-portable model for heavier work also shown herewith, which is to be used with hose and hand tools; and a number of sizes of stationary plants for permanent installation.

Apex Electrical Manufacturing Company.

The vacuum cleaners made by the Apex Electrical Manufacturing Company, Cleveland, Ohio, are provided with special nozzles subdivided in the interior

Apex Vacuum Cleaner, Model A-3.

by means of riffled ribs to cause a uniform suction over the entire width of the nozzle. The nozzle has a broad poking front to enable it to get under furniture easily. The type A-3 cleaner shown herewith is only 6½ inches high, which further aids in ability to get under beds, dressers, davenports, etc. The type B-1 is a somewhat larger and more powerful machine, but has the same general characteristics and because of its poking nozzle is called the "Submarine" type. The nozzle contains a traction-operated revolving brush.

Pittsburgh Electric Specialties Company.

The Pittsburgh Model K cleaner is made by the Pittsburgh Electric Specialties Company, 398 Broadway, New York City. The casing is entirely of aluminum and houses a vertical, air-cooled, universal motor. The nozzle is 12 inches wide and 1½ inches across the opening. It contains a revolving brush that may be quickly removed by shifting a small brush-holding shutter. By moving the regulating button,

the height of the nozzle from the carpet may be readily adjusted. A set of simple handle stops permits the handle to remain in the upward position without use of locking clamps or screws. The bag is made of high-grade khaki and is quickly attached and detached by means of a simple locking device. A special set of attachments can be provided.

The Hoover Suction Sweeper Company.

The makers of the Hoover electric suction sweeper, the Hoover Suction Sweeper Company, New Berlin, Ohio, have made a special feature of the motor-driven brush, included in the nozzle of this device. It is said that this brush vigorously shakes, thoroughly sweeps the rugs and carpets, and in addition cleans them by suction. The brush revolves with considerable speed so as to give the combined action of a broom and suction device. The brush is made of soft hair so as not to injure rugs. By means of this brush combined with the vacuum, the cleaner is enabled to remove light surface dust, clinging dirt, such as threads, hair and lint, and heavily imbedded dirt which has been ground into the warp of the carpet by walking over it and through the use of rocking chairs. This brush is patented by the company. The Hoover cleaners are made in four sizes suitable for the requirements of different sized homes, hotels and public buildings.

TRICO RENEWABLE CARTRIDGE FUSES.

A new type of renewable cartridge fuse has been placed on the market under the name Trico. The distinctive feature of this fuse is that the renewal element is itself a complete inclosed fuse and is carefully made up and powder-filled at the factory. The powder used in the inner cartridge has flame-retarding properties and is introduced to chill the gases formed when the fuse blows and to smother the arc. It increases the accuracy of the fuse and prevents violent explosions on short-circuits. It also serves as a time-limit on the action of the fuse, preventing momentary overloads from interrupting the circuit by needless blowing of the fuse. Being a poor conductor of heat, it prevents the charring and burning of the outer casing and blackening or burning of the contacts.

For sizes below 60 amperes, the ferrule type of fuse is made and for sizes 65 to 600 amperes the knife-blade construction is used. In the former the caps are screwed over the fiber shell up to the terminals of the renewal cartridge and are then secured with heavy brass end screws. In the knife-blade type the renewal cartridges have solid copper terminals that are securely bolted to the blades, thus making perfect copper to copper contact and eliminating the possibility of oxidized and burned renewal-element terminals due to heating at the contact bolts.

To inspect the ferrule type fuse requires merely the removal of one cap and the opposite end screw. To inspect the knife-blade fuse necessitates removal of only one cap. If the fuse has been blown, a slight pull on the terminals of the renewal cartridge permits the link to be drawn out. It is practically impossible to abuse the ferrule fuse because the fuse links cannot be doubled up or wire inserted instead of the Trico renewal cartridge. Abuse of the knife-blade type is minimized because this fuse can be so easily opened for inspection and attempted abuse instantly exposed.

These fuses are made of the highest grade materials and wrought by skilled workmen. The outer casing is of the best quality horn fiber which is impervious to moisture. This casing is highly polished. The metal parts are ground to a bright finish. The entire design provides for but few parts, each of simple and rugged construction. In the knife-blade type the terminals are self-alining, thus insuring perfect contact with the clips and preventing blowouts from heating at the terminals. Each renewal element is carefully filled, individually inspected and uniformly rated by use of calibrated instruments.

The Trico fuses have been rigorously tested and found to meet all the test requirements of the National Electrical Code. Numerous inspection departments have approved their use and inspectors commended them for being exceptionally well made. The convenience of eliminating the bother of powder filling and the safety of using protected, self-contained, renewal elements is appealing to users. Their use is said to reduce fuse-maintenance expense about 75 per cent over the ordinary non-renewable fuse.

Trico Ferrule Type Renewable Fuse Shown Assembled Complete and With End Screw and Cap Removed to Expose the Protected Renewal Fuse Element.

Trico cartridge fuses are manufactured by the Trico Fuse & Manufacturing Company, Milwaukee, Wis. M. B. Austin & Company, 700 West Jackson Boulevard, Chicago, Ill., are the general sales agents for the makers.

Metropolitan Edison Erects Boiler House.—The steel construction work on a boiler house at the West Reading plant of the Metropolitan Edison Company, Reading, Pa., has been started and it is expected that the new structure will be completed in about a month. Two boilers of 1000 horsepower each will be installed in the building, and will increase the normal rating capacity of the boiler house to 12,000 horsepower, or a maximum rating of 30,000 to 36,000 horsepower.

Trico Knife-Blade Renewable Fuse With Cap Removed to Expose Terminal and Renewal Element, Which Is Itself a Cartridge Protected Fuse.

Trade Activities

Hurley Machine Company Located in New Quarters—Hotpoint to Conduct Publicity Campaign—Catalogs Distributed

Triangle Conduit Company, Inc., with general offices and works at 50-54 Columbia Heights, Brooklyn, N. Y. announces the appointment of Alva D. Stein, 156 Purchase street, Boston, Mass., as its New England selling agent.

The Wellman-Seaver-Morgan Company, Cleveland, Ohio, has been awarded a contract for manufacturing and delivering to the Philadelphia and Norfolk navy yards a considerable number of electrically driven capstans, aggregating $96,800.

Cumberland Electric Manufacturing Company, Memphis, Tenn., is sending out a four-page leaflet on its Imperial bell-ringing transformers, which eliminate the use of all classes of batteries and are easily and readily installed. Four types of these transformers are shown and their particular uses described in brief. Data as to sizes, prices, wattage, etc., are contained in the circular.

The Automatic Reclosing Circuit Breaker Company, Columbus, Ohio, is distributing Bulletin 30 on its automatic reclosing circuit breakers and relays for the protection of direct current circuits, which gives a general description, theory of operation and application. These circuit breakers are claimed to afford suitable protection for any direct current circuit subject to overloads and short circuits and are especially adapted to motor generator sets and rotary converters, motor haulage and machine line circuits in mines, crane circuits in steel mills, shipyards, docks and other industrial plants, larry circuits in mills and coke oven plants, and railway sub-stations. The booklet tells how the operation of small sub-stations together with proper alternating current protective devices may be safely and economically accomplished. Several types of circuit breakers and relays are described and illustrated, and several diagrams showing the wiring, dimension and method of application are contained in this bulletin.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is sending out a booklet entitled "Marine Application of Reduction Gears of Floating Frame Type." This is a reprint of the paper presented by John H. Macalpine at the spring meeting of the Institution of Naval Architects of London, held March 29, 1917. This article deals very fully with the design, theory and performance of reduction gears of the floating frame type originally produced by the late Admiral George W. Melville, U. S. N. The most important conclusions reached in the article, briefly stated, are that a floating frame gear will operate perfectly with the pinion sensibly out of line, which overcomes the great difficulty of rigid gears; the floating frame corrects from one-half to two-thirds of the effect of torsional yield of the pinion, and that the performance of gears of any design should be judged by the value of the "power constant" it will safely bear. From data available for rigid gears, it is concluded that the power constant at which gears are usually run is much higher in the case of floating frame gears than of rigid gears. Two marine installations, one of a slow oil tank, single-screw steamship with double reduction, and the other, a faster passenger and freight turn-screw steamer with single reduction, are described in detail and well illustrated by diagrams showing arrangement of machinery, port propelling units, various parts of the gears, etc. Booklet 1584, dealing with "The Further Prospect of Railroad Electrification," by F. H. Shepard, director of heavy traction of the Westinghouse company, is also offered for distribution. In this booklet the author reviews the activities of the railroads during the past year and tells how the problems of labor shortage, lack of fuel, etc., have been met. He states that the electric locomotive of today, in its ability to handle the heaviest trains in congested service, to make long-sustained runs and to remain continuously in service, has demonstrated its unquestionable superiority over any method of steam operation, and tells of the prospects of the electrification of railroads.

Pass & Seymour, Inc., Solvay, N. Y., are sending out a loose leaf perforated page to fit their catalog No. 24, on porcelain Shurlok key and keyless sockets and receptacles. This page, which is numbered 42-A, describes and illustrates these products.

Globe Electric Company, Milwaukee, Wis., through its sales manager, W. R. Patton, announces the opening of an office at 106 North La Salle street, Chicago, Ill., to take care of its increased business in electric farm-lighting plants and storage batteries. This office will be in charge of G. M. Gardner.

The W. G. Nagel Electric Company, Toledo, Ohio, is sending out motor list No. 24, offering bargains in new and remanufactured motors and generators, both alternating and direct current, and other electrical equipment. Every machine listed is modern in every respect and by the Nagel process of remanufacturing is claimed to be as good as new so far as appearance and satisfactory service are concerned. Each piece of machinery is thoroughly overhauled and given a two-hour running test, during which time its performance is carefully watched by an expert. Complete data as to the styles of motors, generators, hoists and starting compensators, prices, etc., are contained in the list.

Hotpoint Division, Edison Electric Appliance Company, Inc., 5660 Taylor street, Chicago, is preparing an extensive publicity campaign for pushing the Hotpoint electric vacuum cleaner. This is known as a patriotic conservation campaign and will consist of large display advertising in several magazines of national circulation. Among these it is arranged to have full-page, two-color "ads" in the May and July issues of the Good Housekeeping magazine, full-page, four-color "ads" in the May and June issues of the Ladies' Home Journal; also full-page, two-color spreads in the May 4 and June 29 issues of the Saturday Evening Post. There is no doubt that many of the millions of readers of these publications will be influenced "to do their cleaning electrically" as a result of seeing these advertisements. Thus, housewives will have more time to devote to the many duties they need to perform for the Nation.

The Reflectolyte Company, 914 Pine street, St. Louis, Mo., is distributing a catalog descriptive of the Reflectolyte system of illumination. The Reflectolyte is a scientifically constructed and mechanically perfect lighting unit, designed to radiate and diffuse the bright light of modern high-intensity lamps. The body of the reflector is made of heavy pressed steel with successive coats of pure white-porcelain enamel fused on, layer by layer, at a temperature which melts glass, and cannot peel or discolor. Reflectolytes are claimed to operate efficiently regardless of the height, shape or color of the ceiling and may be attached to the ears or stud of any outlet box or wood or plaster ceiling. In this publication is introduced the "Ceiling-Bright" Reflectolyte, which is considered a distinct advance in scientific illumination, and the particular advantages afforded by this system of illumination are clearly set forth. A cross-section of the unit, showing the construction, method of attachment, etc., is shown. The catalog contains handsome illustrations of the various styles of Reflectolytes and gives some idea of the attractive ornamental work executed on this line of lighting units.

Hurley Machine Company, Chicago, Ill., is rapidly moving the last of its departments to its large new factory at Cicero, Ill. As shown in the general prospective view on next page, this is a very spacious establishment for the production of the company's well-known Thor electric labor-saving machines for the home—electric washing and ironing machines and vacuum cleaners. The principal product is washing machines and the factory is the largest one in existence making electric washing machines.

Group of Motor-Driven Automatic Screw Machines in New Hurley Factory.

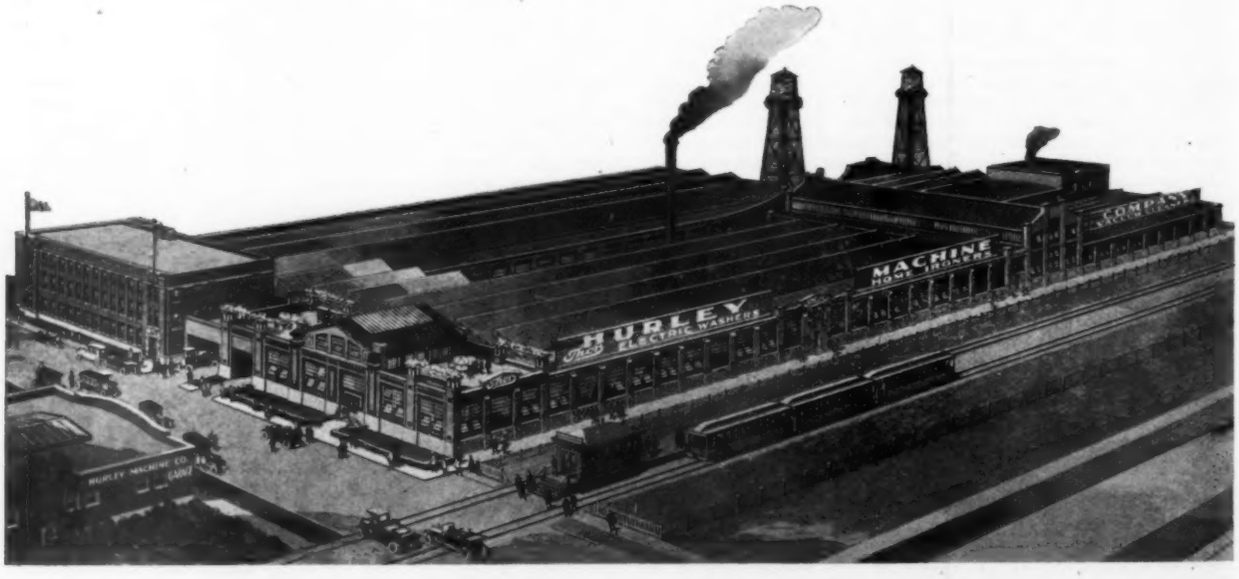
Stock of Kiln-Dried Hard Maple for Washing Machines in One of the Stock Rooms.

Exceptional development is represented by the completion of the new factory of the company, which not many years back had its modest beginnings in small rented quarters. Superior quality in design, materials and workmanship of its products, backed by unusual service features, has shown its impress in the company's rapid growth. Recently the factory had increased to three floors in the building at Monroe and Clinton streets, but these facilities proving entirely inadequate, a six-acre site was purchased at Fifty-fourth avenue, near Twenty-second street, in Cicero, just west of the Chicago city limits. This site is served by a railroad siding, giving good shipping facilities, and lies alongside the right-of-way of the Metropolitan Elevated Railway, which here runs at grade and furnishes rapid transit to the city.

The buildings are of substantial mill construction and for the most part one-story high with saw-tooth roofs, giving unusually good daylight and ventilation. The three-story building contains the general offices and employes' restaurant; it also is exceptionally well lighted, both by day and night. An automatic sprinkler system is installed throughout the establishment. The present buildings have a floor space of 185,000 square feet, or about three and one-half acres. No department is crowded, but has its equipment arranged to the best advantage. Abundant room is left on the opposite side of the street for future expansion. Here a garage is to be built for the company's trucks and automobiles of its officials and city sales force.

Electric power supplied by the Public Service Company of Northern Illinois is used throughout the premises and every possible labor-saving equipment is employed to secure the best possible production and uniformity of product. Special consideration has been given to the welfare of the employes. All workrooms and offices are large, bright, well-ventilated and cheerful. The third floor of the office building is a model kitchen and lunchroom where wholesome food is furnished the employes at cost price. The flat roofs are used in summertime as roof gardens. Every safeguard is provided to minimize accidents, but to take care of any that may occur there is a hospital section with a well-equipped operating room in charge of a skilled physician and surgeon, who is also at the disposal of all employes for free examination and medical advice.

The washing-machine department is along the Metropolitan railroad. It was the first section of the factory to be occupied about five or six months ago. At the extreme right or east end is the foundry, which is now being equipped with a cupola furnace and other necessary apparatus. The northern saw-tooth building houses the vacuum-cleaner and ironing machine departments. In the office section are the executive offices and the general offices of the sales, credit and accounting departments. It is expected to concentrate at the Cicero works all of the manufacturing and practically all of the offices. A Chicago city office will still be retained at 28 East Jackson boulevard, in the Steger building, on the ground floor of which the city demonstration and salesroom is located Here can be seen models of the Thor electric washing machine, which is made in twenty styles; also the Red electric washer and wringer, the Thor ironing machine, made in six styles, and the Thor electric vacuum cleaner, made in two styles.



General View of Hurley Machine Company's New Factory at Cicero, Ill.

Men in Service

Westinghouse Patriotic Association Organized—E. E. Sanford to Serve as Major—J. C. Maxon Receives Commission

A. M. Dodds, who formerly worked with the efficiency force at the Brunots Island Station of the Duquesne Light Company, Pittsburgh, Pa., and enlisted in the Marine Corps, is now located at Fort Crockett, Galveston, Tex.

Electrical Supply Jobbers' Association on its roll of honor lists the names of 1,545 men now enlisted in the ranks of the army and navy, who were formerly in the employ of association members.

J. C. Maxon, formerly of the New York distributing office of the Western Electric Company, who enlisted in the Naval Reserve Force last September, has been commissioned an ensign and has been assigned to the U. S. S. Jupiter.

American Society of Mechanical Engineers of New York City in the March issue of its Journal publishes the ninth installment of its roll of honor. The list contains the names of 83 members enlisted in various branches of government service.

E. E. Sanford, of the securities department of the Northern States Power Company, St. Paul, Minn., will serve as a major during the next Liberty Loan drive for St. Paul, having charge of 10 teams of solicitors for the St. Paul district. Mr. Sanford has also been appointed a member of the Committee on Legislative Research and Recommendation of the St. Paul Association of Commerce.

Bell Telephone Company of Pennsylvania in the March number of Telephone News records the death of John J. Hollowell, the first of its men to be killed in the execution of his duties with the American Expeditionary Forces and was a private in Company D of the 406th Telegraph Battalion, N. A. Private Hollowell was a cable splicer in the Philadelphia plant department of the company and in April of last year enlisted in the First Telegraph Battalion of the Signal Corps.

Pacific Gas & Electric Company, San Francisco, Cal., devotes several pages of the February issue of the Pacific Service Magazine to its roll of honor, which contains the names of 362 employes now in government service. The enlistments from the district offices of the company are as follows: San Francisco, board of directors, 1, general offices, 42, San Francisco district, 96; San Francisco Supply, 6; Alameda County, 54; Chico, 1; Colgate, 6; Contra Costa, 8; Colusa, 1; De Sable, 5; Drum, 5; Electra, 5; Fresno, 5; Martin, 8; Marysville, 16; Napa, 4; Nevada, 3; Petaluma, 1; Placer, 5; Redwood, 21; Sacramento, 27; Sacramento Supply, 5; San Joaquin, 4; San Jose, 28; Solano, 3; Santa Rosa, 2, and Vallejo, 1. The names of 13 employes who have enlisted but have not as yet been called to the colors are also given.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for Men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

The Electrical Review *will welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

The Westinghouse Electric Patriotic Association of Chicago was organized in February by the Chicago district employes of the Westinghouse Electric & Manufacturing Company. Out of a total of 294 employes of the company in this district, 227 were enrolled as members prior to March 1. The membership has materially increased since that date. The by-laws provide for four classes of members: Regular, subscribing, sustaining and honorary members. Any employe of the Westinghouse company who has entered the military or naval service of the United States is eligible to honorary membership. Thus far, the association has 130 regular members, 46 subscribing, 17 sustaining and 34 honorary members. The number given in the last-named class means that there are now 34 Westinghouse employes of Chicago district in the military and naval service of their country, and that the Westinghouse service flag for that district contains 34 stars. It is expected that this roll of honor will be increased to about 50 very soon.

The object of this association is to enable its members to play a patriotic part in the affairs of the nation. The plan is to maintain inter-communication between home members and those at the front, giving and receiving news of mutual interest; to safeguard the home interests of, and to perform missions for, those in service; to contribute articles of comfort, and arrange for the transmission of same to the members in service. Necessary funds for the association's work are raised by initiation fees and monthly dues.

A board of directors of ten members is made up of the several heads of departments. The directors appoint an executive committee of three of its members who will have control of expenditures.

There are also committees on membership, correspondence, publication, welfare and comfort, the functions of each one being defined in relation to its work among home members and members in service. The publication committee's duties are to procure news of current interest to all members, at home and abroad, and publish same in the association's monthly bulletin called *Just News*, the first issue of which appeared in February. It contains news from soldier and sailor members at the front, as well as much home news of interest to them. Copies will be sent to those young men as a reminder to them of the interest, sympathy and fidelity of those at home.

The members of the Board of Directors are:

T. Julian McGill, manager; Malcolm Carrington, assistant manager; C. E. Allen, manager supply division; N. G. Symonds, manager industrial division; C. W. Regester, manager power and railway divisions; W. H. Bell, manager service division; R. A. Simpson, superintendent service division; W. S. Long, manager treasury and accounting division; F. S. Moyer, chief clerk; J. B. Gaylord, storekeeper.

Officers: W. R. Pinckard, president; H. E. Driver, vice-president; P. E. Hanaver, secretary; F. W. Ferguson, treasurer.

Executive Committee: Malcolm Carrington, W. S. Long and W. H. Bell.

F. B. Jewett, chief engineer of the Western Electric Company, was recently advanced from the rank of major to that of lieutenant-colonel.

Western Electric Company has added the names of 78 employes to its honor roll since the publication of its last issue of the News. The additional enlistments from the various offices of the company are as follows: New York, 8; Richmond, 2; Chicago, 1; Cincinnati, 2; St. Louis, 1; Kansas City, 3; Denver, 1; San Francisco, 12; Seattle, 23, and Hawthorne, 25.

Hurley Machine Company, Chicago, Ill., now has a roll of honor carrying 27 names of its employes who have joined various branches of government service. These men are as follows: Thomas Brennan, A. Culling, Ray Cunningham, Ed. Dobraske, J. Galvin, Frank Gordon, E. B. Hall, H. Hallsten, Cole Hawthorne, L. C. Heurlin, D. Hines, Willard Hudson, E. N. Hurley, Jr., R. J. Hurley, G. M. Kendall, John Koepfle, D. McCaughan, Ed. Mackey, Charles Matschke, A. R. Nixon, R. J. Pitcher, Charles Ploger, G. S. Smith, P. H. Smith, Robert Voss, W. J. Walsh and S. Wankat. E. N. Hurley, Jr., son of the head of the United States Shipping Board and Fleet Corporation, is serving on the staff of Director-General of Railroads McAdoo. R. J. Hurley is a first lieutenant in the United States Army.

Personal

Leon O. Hart Elected Treasurer Driver-Harris Company George Edward Sisley and William H. McKinlock Expire

JOHN E. THAYER, JR., was recently elected a member of the board of directors of the Edison Electric Illuminating Company of Boston to succeed C. Minot Weld, resigned.

R. C. COFFY, formerly manager of the Puget Sound Gas Company, Everett, Wash., has been appointed manager of the Sapulpa Electric Company, Sapulpa, Okla., succeeding George H. Wilmarth who resigned.

GEORGE W. STRACK, JR., who has been connected with the Bureau of Safety, Chicago, for four years, has become safety agent for the Central Illinois Public Service Company, Mattoon, Ill., and will thus assume a responsible position with one of the largest and most important Middle West properties.

GEORGE J. JACKSON, for many years secretary and treasurer of the National Conduit & Cable Company, with main offices in New York City, has been elected president of the company to succeed Edward S. Perot. Mr. Jackson was an important factor in the company before it was refinanced in 1916, but retired for a time because of ill health.

CHARLES PRESBREY, a director of the Frank Presbrey Company, advertising agents, of New York, N. Y., has been appointed chairman of the Trade Paper Advertising Department of the War Savings Committee of Greater New York. Mr. Presbrey has already set a score of able copywriters to work preparing advertisements for the trade publications.

WILLIAM G. IRWIN, Columbus, Ind., president of the Indianapolis, Columbus & Southern Traction Company, has been elected president of the Chamber of Commerce of Columbus, his business colleagues declaring that he has been drafted for this service. Mr. Irwin was absent from Columbus when his name was presented and his election followed. He is president of Irwin's Bank of Columbus and is a member of the State Council of Defense of Indiana.

G. A. STRAIN was recently promoted from the position of superintendent of the gas department of the Helena (Mont.) Light & Railway Company to general superintendent of the following properties, with headquarters at Ithaca, N. Y.: Groton Electric Corporation, Groton, N. Y.; Standard Light, Heat & Power Company, Sidney, N. Y.; Homer & Cortland Gas Light & Electric Corporation, Cortland, N. Y.; Norwich Gas & Electric Company, Norwich, N. Y.; Van Wert Gas Light Company, Van Wert, Ohio; Ovid Electric Company, Ovid, N. Y.; Cayuga Power Corporation, Ithaca, N. Y.; Ithaca Gas & Electric Corporation, Ithaca, N. Y., and Oneonta Light & Power Company, Oneonta, N. Y. For the past 12 years Mr. Strain has been associated with the J. G. White Management Corporation, New York City, which controls the above mentioned concerns.

BENJAMIN V. BECKER, of Chicago, has been elected a director of the Westinghouse Air Brake Company, Wilmerding, Pa., which increases the number of its board of directors from nine to ten.

C. E. TUOHEY, for several years manager of the fixture sales department of the Sanborn Electric Company, Indianapolis, Ind., is now connected with the sales department of the Beardslee Chandelier Manufacturing Company, Chicago.

LEON O. HART, assistant treasurer of the Driver-Harris Company, Harrison, N. J., at the annual meeting of the stockholders and directors of the company was elected treasurer and a director of that concern. Mr. Hart was born in Hoboken, N. J., in 1885 and was educated at the Stevens Institute of Technology, from which institution he

Leon O. Hart.

graduated in 1907 with the degree of mechanical engineer. After his graduation, he was employed with the Public Service Gas Company of New Jersey as a cadet engineer for about one year. On October 2, 1908, Mr. Hart became associated with the Driver-Harris Company as electrical engineer, in which capacity he served until March, 1917, when he was elected assistant treasurer. Mr. Hart is a member of the American Electrochemical Society, and also the American Institute of Electrical Engineers, and is widely known throughout electrical industries because of his association with these societies as well as with the Driver-Harris Company.

PAUL A. WESTBURG, Chicago representative of the Weston Electrical Instrument Company, was married on March 6 to Miss. A. V. Bowman. Mr. Westburg has been engaged in the electrical business in Chicago for a number of years, and was formerly associated with the late Professor Badt under the firm name of Badt & Westburg.

EDWIN A. MOORE has resigned his position as works manager of the Union Switch & Signal Company, Swissdale, Pa., to become manager of the Liberty Ordnance Company, Bridgeport, Conn.

F. H. SMOCK, until recently sales manager of the Eastern Wisconsin Electric Company, Sheboygan, Wis., has joined the sales force of the Bryan-Marsh Division of the National Lamp Works of the General Electric Company, whom he will represent in the South.

Obituary.

GEORGE E. SISLEY, associate editor, International Trade Press, Inc., passed away suddenly on March 13 after a short illness. Mr. Sisley was 53 years old and had a broad acquaintance among Chicago newspaper and electrical men and was very widely known in the mining world, with which he was closely connected for about fifteen years as associate editor of the *Mining and Engineering World*. He was a member of the Elks, the Woodmen and Masonic fraternities. He is survived by two brothers, L. A. Sisley, secretary of the Electrical Review Publishing Company, and W. L. Sisley, of Olney, Ill., one sister, Mrs. C. H. Backus, of Hampshire, Ill., and one son. His son, an artist with the *Chicago Tribune*, is now a sergeant serving in France with the One Hundred and Forty-ninth Field Artillery.

P. C. HARMON, secretary and manager of the Wells Electric Company, New Richmond, Wis., met with instant death on February 18, as the result of an accident. Mr. Harmon had been in Ohio specializing in the subject of storage batteries for the company and had completed his work and was about to return home when the accident occurred. He was also secretary and manager of the St. Croix Telephone Company of New Richmond. A widow and three children survive him.

WILLIAM H. MCKINLOCK, one of the very widely known pioneers in the electrical industry in the Middle West, died on March 11 at his home in Chicago after an illness of about six months. His death came as a shock to scores of his business associates and friends. Mr. McKinlock and his brother, George A., were the founders of the Central Electric Company of Chicago in 1887. Later the deceased sold his interest in the company to his brother, who has remained as president of the company continuously since that date. After severing his connection with the Central Electric Company, Mr. W. H. McKinlock founded the Metropolitan Electric Supply Company. During the last five years he has been at the head of the American Manufacturers' Agency of Chicago. Mr. McKinlock was a brother of George A. and Dr. John McKinlock, the latter a prominent physician of Chicago.

Recent Patents

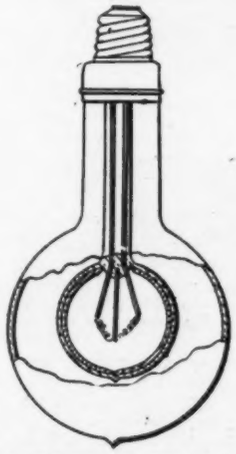
Selected and Summarized by Albert Scheible, Patent Attorney, 79 West Monroe Street, Chicago, Illinois

A series of brief comments on some of the recently issued electrical patents which appear to be of particular interest to our readers, the number after each heading being that of the United States patent to which the summary relates. Any correspondence regarding such patent matters should be sent direct to Mr. Scheible at the above address.

Submarine Destroyer (1,253,482).—In fishing for submerged submarines, John A. Gault, of Lancaster, Wis., uses an electromagnet at the end of a cable which is towed by the vessel, the magnet being drawn to the armor of the submarine.

Welding Controller (1,253,198).—For arc welding, Theo. D. Montgomery, of East Orange, N. J., and Leroy C. Schantz, of Milwaukee, Wis., provide automatic means for increasing the voltage of the generator after the electrodes have been separated to draw an arc. Patent assigned to the Cutler-Hammer Mfg. Co., of Milwaukee.

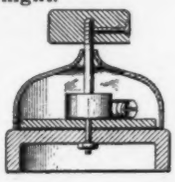
Gas-Filled Incandescent Lamp (1,252,372).—To reduce the loss of heat by the continuous passage of relatively cool gas over the filament of a tungsten lamp, William A. Darrah, of Mansfield, Ohio, surrounds the filament either partly or wholly by a transparent envelope made of a material which will withstand the heat. This envelope soon becomes coated with deposit radiated from the filament, hence the patentee coats the envelope initially with a flux which oxidizes the deposit so as to make the latter both colorless and transparent.



No. 1,252,372.—Gas-Filled Lamp.

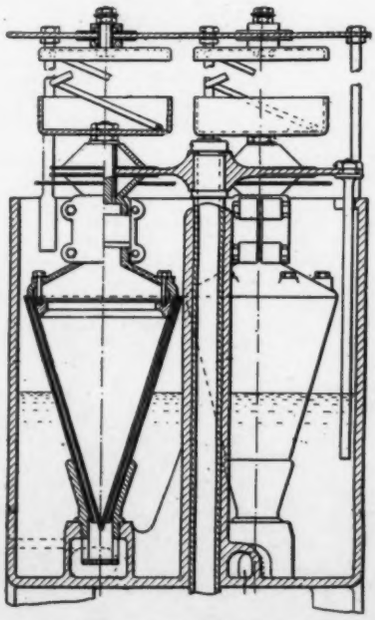
Roentgen-Ray Anode (1,253,156).—A composite anode shown in this patent, assigned by William D. Coolidge to the General Electric Company, consists of a plate of highly refractory metal in intimate heat-conveying relation to a soft metal conductor to which the heat is transferred at a substantially constant rate.

Luminous Switch (1,253,147).—By using a glass globe in place of the usual metal casing of a snap switch, Georgia Santostefano della Cerda, of Viareggio, Italy, exposes the mechanism of the switch to view. Then he applies a luminous substance to the switch base, thereby making it easy to find at night.



No. 1,253,147.—Luminous Switch.

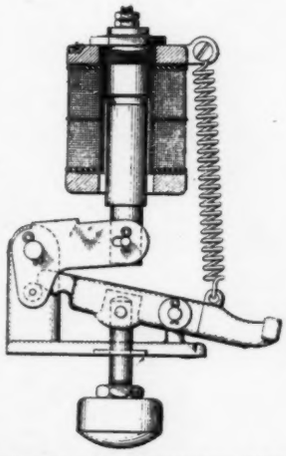
Regulating Resistance for Multiphase Motors (1,251,982).—For this purpose, Fredrik Ljungstrom, of Finspong, Sweden, uses as many resistance units as there are phases, each unit consisting of a pair of metal funnels spaced so as to permit a thin layer of liquid between them. The resistance can be varied by simultaneously raising or lowering all of the upper funnel parts and thereby altering the thickness of the film of liquid, and the liquid is kept flowing continuously so as to prevent its overheating.



No. 1,251,982.—Polyphase Motor-Regulating Resistance.

Elevator Signal System (1,255,866).—Edward L. Dunn, of Worcester, Mass., according to this patent, assigned to the Standard Plunger Elevator Company, interconnects the well lights and the corridor lights, and shows connections controlled by a traveling switch for dominating the well lights. Then he also has a switch on the car for cutting out the corridor or up-and-down signal lights while still having the well lights separately under control of the elevator man.

A Non-Chattering Electromagnet (1,253,409). — In alternating-current magnets, the reduction in pull on the movable core when the voltage passes through zero is apt to cause the core to chatter against the pole piece. To reduce, or even eliminate, this chattering, David W. Martin and Robert F. Thompson have constructed a magnet in which the movable core bears flat against the pole piece at the end of its travel, and in which the parts are kept in alinement even after the core is disengaged from the pole piece. The patent was assigned to the General Electric Company.



No. 1,253,409.—Non-Chattering Electromagnet.

Portable Fan (1,254,042).—Those using fans for hair-drying, or other operations in which it is desirable to move the fan into a variety of positions, will be interested in this patent to Fred C. Howe, of New Haven, Conn. He mounts a small electric fan on a handle, and pivots two legs to the handle, so that the two legs and the handle will form a tripod for the fan when set down. At other times the legs can be folded out of the way.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

BINGHAMTON, N. Y.—Binghamton Light, Heat & Power Company has been granted permission by the Public Service Commission to issue bonds for $100,000, to provide for extensions, improvements, etc.

BROOKLYN, N. Y.—Kings County Electric Light & Power Company, 360 Pearl street, is planning for a bond issue of $1,000,000, to provide for extensions, improvements, etc. Application has been made to the Public Service Commission.

BUFFALO, N. Y.—The City Council is considering plans for the complete electrification of the Buffalo Belt Line.

BUFFALO, N. Y.—Plans have been completed by the Bell Telephone Company for taking over and operating the systems of the Federal Telephone & Telegraph Company, the Chautauqua County, Niagara County, Home Telephone Companies, Buffalo.

CANASERAGA, N. Y.—Notice has been filed with the Public Service Commission of the merging of the Canaseraga Telephone Company with the Caroline Telephone Company, Caroline, N. Y.

DUNKIRK, N. Y.—Dunkirk Home Telephone Company and the Hanover Telephone Company have filed notice of the merging of the two concerns.

EAST SYRACUSE, N. Y.—The City Council has approved an appropriation of $7,000 to be used for street-lighting purposes, as requisitioned for in the annual budget for 1918.

ELMHURST, L. I., N. Y.—New York & Queens County Electric Light & Power Company, 44 Jackson avenue, Long Island City, is planning for the construction of a large plant on its eight and one-half acre tract on Woodhaven avenue, recently acquired. The property is located near Trotting Course Lane and has a frontage of 600 feet on the Long Island railroad.

NEW YORK, N. Y.—Gagen & Butler, operating an electrical contracting establishment at 1402 Broadway, have filed notice with the Public Service Commission of an increase in their capital from $15,000 to $50,000, to provide for expansion.

NEW YORK, N. Y.—New York Edison Company, 130 East Fifteenth street, has had plans prepared for the construction of a one-story repair shop, about 50x70 feet in size, at 720 First avenue.

ROCHESTER, N. Y.—Lock Insulator Manufacturing Company has filed notice with the Public Service Commission of an increase in its capital from $800,000 to $1,000,000 to provide for expansion.

BARRINGTON, N. J.—The Borough Council has completed improvements in its electric street-lighting system.

CAMDEN, N. J.—New York Shipbuilding Corporation has had plans prepared for the construction of a one-story steel and concrete addition, about 109x118 feet in size, to its power house.

HACKENSACK, N. J.—Application has been made to the Board of Public Utility Commissioners by the Gas & Electric Company of Bergen County for permission to issue bonds for $700,000 for extensions and improvements in its plant, etc.

JERSEY CITY, N. J.—Authorization papers have been filed by the Down Town Electrical Company to operate at 184 Newark avenue in an electrical contracting capacity. Jacob B. Schneitzer, 351 Henderson street, heads the company.

KEYPORT, N. J.—Keyport Lighting Company is making rapid progress in improvements at its power house, and it is expected that the work will be completed at an early date.

NEWARK, N. J.—The city commissioners are planning for the immediate installation of a large heating plant at the City Hall, which will also furnish heat to the new police headquarters now nearing completion.

PERTH AMBOY, N. J.—American Smelting & Refining Company has awarded a contract to Ira Crouse, 495 State street, Perth Amboy, for the construction of a one-story addition to its power house at Maurer. The structure will be about 60x70 feet in size.

PITMAN, N. J.—Electric Company pany of New Jersey has been granted permission by the Board of Public Utility Commissioners to issue bonds to the amount of $197,000 to provide for improvements, extensions, etc.

TRENTON, N. J.—A bill has been passed in the New Jersey legislature authorizing street railway companies to carry freight and express matter.

TRENTON, N. J.—Plans are under consideration by the City Commissioners for taking over and operating under municipal ownership the system of the Trenton & Mercer County Traction Corporation.

BLAIN, PA.—Perry County Telephone & Telegraph Company is making rapid progress in the extension of its telephone lines from Blain to New Germantown, and it is anticipated that the work will be completed at an early date.

BURLINGTON, PA.—Delaware & Atlantic Telephone & Telegraph Company has had plans prepared for alterations and additions to its local administration building.

COALDALE, PA.—Panther Creek Valley Hospital is having plans prepared for the construction of a one-story addition to its power house, about 40x60 feet. Louis Stockton, 35 West Thirty-ninth street, New York, is the architect.

EASTON, PA.—Construction work on a tie line between the systems of the Pennsylvania Utilities Company and the Lehigh Valley Transit Company, Allentown, has been completed, a section of the line being constructed for 13,200 volts and the remainder for 33,000 volts. The new line will provide for an interchange of about 1200 kilowatts, and will facilitate matters in the event of a breakdown in either system.

ERIE, PA.—An ordinance providing $22,000 for carrying out the conduit system along State street has been passed by the Council and Director Eichorn will invite bids for the bonds for this improvement on or after March 4.

HARRISBURG, PA.—Application has been made to the Public Service Commission by the Bernville Light, Heat & Power, Penn Mills Light, Heat & Power, and the Jefferson Light, Heat & Power Companies, all Berks county corporations, for permission to consolidate.

HARRISBURG, PA.—Harrisburg Railways Company is planning for the immediate installation of automatic stokers in its main power plant and substation at Reily and Marion streets.

HARRISBURG, PA.—Application has been filed with the Public Service Commission for permission to merge the following companies: Smithport Power, Port Allegheny Fower, Bradford Township Power, Liberty Township Power, Lafayette Township Power, and the Keating Power Companies, all of McKean county.

HAZLETON, PA.—Harwood Electric Company, which operates in Luzerne, Schuylkill, Columbia and Northumberland counties, has filed notice with the Public Service Commission of an increase in its rates for industrial and street lighting in the Sheppton and Nuremburg districts.

WAYNESBORO, PA.—Greencastle & Waynesboro Railway Company, Bank building, is having plans prepared for the construction of a two-story substation, about 40x50 feet, to cost $10,000. R. D. Safton is superintendent.

PHILADELPHIA, PA.—Philadelphia & Reading Railway, Reading Terminal, is having plans prepared for the construction of a two-story power house of brick and concrete construction, to be located at Tulip and Somerset streets. Samuel T. Wagner is engineer for the company.

BOWERS, DEL.—A company is being organized to erect an electric light plant and install lights throughout the town. Address W. E. Kelly.

WILMINGTON, DEL.—People's Heat, Light & Power Company has filed notice with the Public Service Commission of a change in its corporate name to the Seaboard Electric Company.

WILMINGTON, DEL.—Sugar Refining Company is having preliminary plans prepared for the construction of a large power house in connection with its proposed new sugar refinery, to be located on the Delaware river, and which project is estimated to cost approximately $10,000,000.

HAMPTON ROADS, VA.—The United States Government is having plans prepared for the installation of a fire alarm system at its local yards. C. W. Parks is chief of the Bureau of Yards & Docks.

PETERSBURG, VA.—Virginia Railway & Power Company will build a high power electrical transmission system from Petersburg to Norfolk at a cost of $750,000. Electricity will be distributed for lighting and power in Petersburg and Norfolk and to many towns between these two cities. Address general manager of the company at Richmond, Va.

PENSACOLA, FLA.—Pensacola Electric Company has under consideration the erection of a 13,200-volt transmission line to the Pensacola Naval Station.

NORTH CENTRAL STATES.

ATHENS, OHIO.—Central Electric Company has started work on the installation of new equipment at its plant, including additional 2000 horsepower boilers, three 2500-kilowatt, 2300-volt General Electric turbogenerators, with the necessary transformers, switching apparatus and other accessories. J. T. Magruder of Nelsonville is superintendent of overhead distribution.

ATTICA, IND.—The municipal light and water plant was destroyed by fire March 9, during the heavy gale which passed over Indiana and Ohio.

EVANSVILLE, IND.—Indiana Public Service Commission has granted a surcharge on power service effective for the remainder of the year 1918 to the Public Utilities Commission of Evansville, Ind. In issuing the order, the Commission stated it should be understood that, while it is in favor of giving emergency relief during the war, it will not consent to shifting all of the war burden on patrons. Numerous power patrons protested after the petition for a surcharge was filed. Later, the consumers and the company reached an agreement, which the Commission ratified in the order.

FORT WAYNE, IND.—The Indiana Public Service Commission will conduct a hearing March 20 on the merging of the Bell and the Home Telephone Companies' exchanges in Fort Wayne and a combination of the toll lines of the two

companies under the supervision of the Bell company. The merger includes the selling by the Home Company of its interests in Kendallville and Auburn for $62,500 and the purchase of the Fort Wayne property of the Bell company for $10,000.

INDIANAPOLIS, IND.—Permission has been granted by the Indiana Public Service Commission to the Northern Indiana Gas & Electric Company to add a temporary surcharge of 20 per cent to all bills for electric current in excess of $100 a month in Michigan City, Hammond, Whiting, East Chicago and Indiana Harbor. The order dates from March 1, 1918, and runs not longer than February 28, 1920. The order does not affect bills under $100 a month.

INDIANAPOLIS, IND.—An order readjusting the rates of the Winona Telephone Company has been issued by the Indiana Public Service Commission. The company operates in Plymouth, Knox, Winamac, Monterey, Hamlet, Kewanna, Grass Creek and in rural territory adjacent to those points. The Commission appraised the property of the company and by the order the rates are reduced in Plymouth and increased in some other places. The Plymouth rate, which was $2 a month, is to be $1.90, the 10 cents difference to be allowed for the cash payment of bills. Increases were allowed on some of the rural lines.

ASSUMPTION, ILL.—Assumption Mutual Telephone Company has filed a petition with the Illinois Public Utilities Commission asking for permission to issue notes of $4500.

CHARLESTON, ILL.—A bond issue of $20,000 providing water works and electric light improvement has been authorized. Address Thomas T. Shoemaker.

CHICAGO, ILL.—The drainage board voted to spend $50,000 on rehabilitating the electrical system although the engineers reported $200,000 necessary for the work. Address secretary of board.

DECATUR, ILL.—Illinois Traction System is speeding up the repair of electric motors which were disabled during the winter blizzards two months ago. The company had about 30 electric locomotives which were so damaged during the storms that their further use was prohibited until extensive electrical repairing had been done.

DE KALB, ILL.—City will receive bids for the sale of 64 G. E. 6.6 ampere ornamental luminous magnetite arc lamps, catalogue number 36537-36, in service four years. Full information may be received from J. R. Craworth, consulting engineer, 140 South Dearborn street, Chicago. J. R. Blackman, city clerk.

HARRISBURG, ILL.—Southern Illinois Light & Power Company has been given permission by the Illinois Public Utilities Commission to issue $279,000 of first mortgage gold bonds and capital stock to the amount of $402,100. The company was also given a certificate of convenience and necessity to operate a plant.

HOOPESTON, ILL.—Sanborn Electric Company, Indianapolis, Ind., has been awarded the contract for supplying two searchlights for this city to serve as markers for United States aviators making night trips from Chanute Field, Rantoul, Ill., to Wilbur Wright Field, Dayton, Ohio.

LINCOLN, ILL.—The Lincoln Municipal Railway's receipts for February, 1918, were $1,318.70, the largest since the city assumed charge except for the month of August, 1917.

ROCKFORD, ILL.—The proposition to issue bonds in the sum of $500,000 for the purpose of establishing a municipal lighting plant will be voted on at the April election. Address city clerk.

ROCKFORD, ILL. — Rockford City Traction Company has filed a petition with the Illinois Public Utilities Commission asking for a straight 6 cent fare in Rockford and environs and for the elimination of the sale of all coupon books and other fare reducing methods.

SPRINGFIELD, ILL.—Public Service Company of Northern Illinois has been given permission by the Illinois Public Utilities Commission to issue $1,334,000 of first refunding mortgage gold bonds.

READING, MICH.—The question of issuing $8,000 water and light improvement bonds will be submitted to vote. Address village clerk.

DATES AHEAD.

Wisconsin Electric Association. Annual meeting, Pfister Hotel, Milwaukee, March 27-28, 1918, Secretary, George Allison, 1419 First National Bank building, Milwaukee, Wis.

Tri-State Water & Light Association. Annual meeting. Charlotte, N. C., April, 1918. Secretary-Treasurer, W. F. Steiglitz, Columbia, S. C.

Southwestern Electrical & Gas Association. Annual convention, Galvez Hotel, Galveston, Tex., April 15-16. Secretary, H. S. Cooper, 405 Slaughter building, Dallas, Texas.

American Association of Engineers. Annual meeting, May 14, 1918. Secretary-Treasurer, A. H. Krom, 29 South La Salle street, Chicago.

Arkansas Association of Public Utility Operation. Annual convention, Arlington Hotel, Hot Springs, Ark. May 21-22-23. Secretary-Treasurer, R. B. Fowles, Pine Bluff, Ark.

Electrical Supply Jobbers' Association. Annual meeting, Homestead Hotel, Hot Springs, Va., May 28-30. Secretary, Franklin Overbagh, 411 South Clinton street, Chicago.

Electrical Contractors' Association of Georgia. Annual meeting, Tybee Island, Ga., June, 1918. Secretary, Dan Carey, 614 Chamber of Commerce building, Atlanta, Ga.

National Electrical Credit Association. Annual meeting, June 1, 1918. Secretary, Frederic P. Vose, 1350 Marquette building, Chicago, Ill.

Texas State Association of Electrical Contractors. Annual meeting. Galveston, Tex., June 15, 1918. Secretary, H. S. Ashley, Fort Worth, Tex.

Southeastern Section, National Electric Light Association. Annual meeting, June 19-20, 1918. Atlanta, Ga. Secretary-Treasurer, T. W. Peters, Columbus, Ga.

Northwest Electric Light & Power Association; affiliated with N. E. L. A. Annual meeting, September 11, 1918. Secretary, George L. Myers, Pacific Power & Light Company, Portland, Ore.

HUTCHINSON, MINN. — Northwest Light & Power Company has sold its entire stock of electric wiring supplies to Heilman & Blakeslee and will no longer do wiring work in this city.

DUBUQUE, IA.—Fire, on February 21, destroyed the power plant of the Farley & Loetscher Company, with a loss estimated at $20,000.

OSSIAN, IOWA. — Ossian Electric Light & Power Company, of which Harry Bullard was the owner, has been sold to A. G. O'Rear, of Mason City, who has taken possession. Improvements will be made in the plant.

EDINA, MO.—Edina Telephone Company proposes some extensive improvements in its plant.

KANSAS CITY, MO.—Permit was taken out February 27 by the Kansas City Light & Power Company for the erection of its new power plant at Front street and Park avenue. The structure will have a frontage of 244 feet, a depth of 185 feet and will be four stories high.

KANSAS CITY, MO.—The Interurban Central Station Company has filed a bond of $50,000, thus assuring the erection of the new interurban union station at Tenth and McGee streets. The franchise for this station was passed January 7 and was accepted by the company February 5, when a certified check for $10,000 was filed with the city comptroller, which check was withdrawn upon the filing of the bond.

META, MO.—Fritz Schallert is considering the installation of an electric light plant here.

CHAPMAN, KANS.—Workmen for the United Telephone Company will soon begin on the company's new transformer station. The company expects to make a number of important improvements on the property this spring.

OAKLEY, KANS.—The city has been planning a transmission line from Colby to Oakley and the former city furnishing electric current for the latter town for lights and power. The Oakley plant is not large enough to take care of the increasing demand. It seems to be the opinion of the Colby officials that they have the current and all they want is some way to get it over to Oakley.

YATES CENTER, KANS.—A tornado February 28 in Yates Center wrecked the city electric light plant.

HEBRON, NEB.—Declining the increase in rates proposed by the Lincoln Telephone & Telegraph Company as unpatriotic and unjustifiable, Hebron citizens at a mass meeting recently made plans to fight the raise and sent a delegation to the hearing before the state railway commission in Lincoln. The meeting was called by President Campbell of the Community Club in response to a petition with 170 signers. Sentiment was strong for the organization of a mutual company if the raise went into effect.

JUNIATA, NEB.—Election to vote $6,800 in bonds to construct transmission line to Hastings carried.

SOUTH CENTRAL STATES.

LOUISVILLE, KY.—Louisville Gas & Electric Company has disposed of an issue of $1,600,000 in 7 per cent gold notes.

CLINTON, MISS.—The municipal electric light plant will be enlarged at a cost of $8000. Address M. Latimer, mayor.

VICKSBURG, MISS.—Vicksburg Light & Traction Company is installing a 1500 kilowatt turbine at its power plant.

CONWAY, ARK.—The council committee on light, water and sewer systems has directed Superintendent E. W. Leverett to secure bids for the installation of a new 150 horsepower engine and generator for the light plant.

BLACKWELL, OKLA.—This city has voted $20,000 in bonds for improving electric light, water and fire departments.

STILLWATER, OKLA.—Election to vote $130,000 in bonds for the extension of water system and $30,000 for extension of light system and plant carried.

BOWIE, TEX.—The electric light and power plant here, owned by the Texas Power & Light Company, which was recently destroyed by fire, will be replaced by a new plant of larger capacity.

EL PASO, TEX.—County auditor J. A. Escajeda was authorized to advertise for bids for 600 bulbs for the dome of the court house auditorium.

FORT STOCKTON, TEX.—Manager E. W. Gors of the Pecos & Rio Grande Telephone Company has decided to extend a better telephone line into Loon Valley. Construction work will be begun as soon as necessary material can be procured to build the line.

MCKINNEY, TEX.—The Union Telephone Company and the McKinney Telephone Company of this city Feb. 23 agreed to the recent ordinance passed by the city commission requiring the two companies to merge without an increase in rates. The companies are given three months in which to perfect the actual consolidation.

PLEASANTON, TEX.—At a meeting of the town council it was voted to take over the local light plant for a period of 60 days to test municipal ownership. If it proves successful the plant will be bought by the city.

WACO, TEX.—The city commission has granted a franchise to the Texas Electric Railway for the construction of a number of switches, spur tracks and extensions of its lines here.

WESTERN STATES.

KINGMAN, ARIZ.—The Desert Power & Water Company will construct electric power transmission lines to Hackberry and to the Cyclopkic Mining Camp at a cost of $90,000. This company's power transmission system already extends to Oatman, Chloride and other ore producing districts.

CENTRALIA, WASH.—Water, Light & Power Company has been incorporated by F. M. Lewis and others for the purpose of manufacturing and using a propeller type current water motor which will operate pumping machinery for

placing water on desert land. The device was patented by Mr. Lewis.

CHEHALIS, WASH.—Central Light & Manufacturing Company has filed a petition with the Lewis county commissioners for a franchise to construct and operate an electric light and power line between Walville, at the Lewis-Pacific county line to Meskill. The company asks permission to use the county roads for its work if needed. A 50-year franchise is asked.

SEATTLE, WASH.—City Engineer A. H. Dimock has submitted plans for the proposed elevated railway to the shipyards. The Board of Public Works has taken the plans under consideration. As planned the road is to be a timbered elevated roadway to extend from First avenue South and Washington street to West Spokane street and West Waterway and is to permit of more rapid transit to Riverside, the ship yards and West Seattle. The estimated cost is approximately $350,000.

TACOMA, WASH.—The proposal to acquire the Tacoma Railway & Power Company railway system by the city is to be placed on the ballot at the primary election April 2 for the consideration of the voters while the proposal to purchase a power site and plant will be placed on the ballot at the regular election April 16.

WALLA WALLA, WASH.—L. A. McArthur of the Pacific Power & Light Company states that the light service here is to be greatly improved in the near future.

REEDSFORT, ORE.—A deal, which has been pending for several months between James R. Wheeler and Arthur Blanchard of Marshfield and the Gardiner Light & Power Company has been consummated and a new power company organized to be known as the Umpqua Power Company and will take over the Gardiner Light & Power Company plant. The latter plant will be removed and light will be furnished to that town from the plant which will be located at Reedsport. It is anticipated that the new company and the Coos & Curry Telephone Company will plan a joint pole system.

ROSEBURG, ORE.—Pacific Telephone & Telegraph Company will reconstruct its lines along the Pacific Highway in Douglas county.

DEL MAR, CAL.—Del Mar Water, Light & Power Company has made a petition to sell its electric distributing system to the San Diego Consolidated Gas & Electric Company for a consideration of $11,035.70.

FRESNO, CAL.—San Joaquin Light & Power Corporation has filed with the railroad commission an application for authority to issue $1,000,000 of its 6 per cent first and refunding mortgage bonds. The proceeds from the bond sale are to be used to complete additional facilities upon which work has already started.

REDDING, CAL.—The Redding Chamber of Commerce has unanimously adopted a resolution endorsing the proposition of bonding the city for $40,000 to complete the municipal lighting system.

SAN FRANCISCO, CAL.—Plans for a $50,000 power development to be installed on the east side of the Sierras were presented to the State Water Commission in the application of A. M. Wishart, Alexander Cameron and Jabez Herrin, to secure the necessary water rights. Address Jabez Herrin, Yerington, Nev.

NEW PUBLICATIONS

HYDRO-ELECTRIC POWER COMMISSION.—The ninth annual report of the Hydro-Electric Power Commission of the Province of Ontario for the fiscal year ended October 31, 1916, is now being distributed. This book, which contains 213 pages, gives descriptions, with computed tables of daily gauge height and discharge of the important creeks, falls, rivers, etc., in the Province during 1915-1916. Copies of this report may be obtained from W. W. Pope, secretary of the Hydro-Electric Power Commission, Toronto, Ontario, Canada.

THE COLLAPSE OF SHORT THIN TUBES.—The Engineering Experiment Station at the University of Illinois has issued Bulletin 99 by A. P. Carman, professor of physics, which deals with "The Collapse of Short Thin Tubes." The booklet is divided into two sections, the first of which is devoted to the results of previous experiments on the collapse of tubes. The greater part of the bulletin is given over to a series of tests on short, thin tubes of seamless steel, seamless brass, aluminum, glass and rubber, the purpose of which was to find an equation by the application of which the pressure required to collapse a tube can be calculated when the dimensions of the tube and the elastic properties of the material are known. Valuable data which may be applied in designing condenser tubes are contained in this paper.

CODE OF LIGHTING SCHOOL BUILDINGS.—The Illuminating Engineering Society, New York City, announces that the revised edition of its Code of Lighting School Buildings will soon be ready for distribution. The first edition of this Code was circulated several months ago for the purpose of obtaining discussions and criticisms with the result that over 100 communications have been received from lighting experts, architects, educators and school superintendents. These have been given the careful consideration of the Committee on Lighting Legislation in its revision of the technical data and principles of school lighting which are embodied in the Code. Approximately 20,000,000 school children in the United States daily perform work trying to the eyes and in this connection proper illumination is essential. Available statistics show that nearly 10 per cent of the school children, who have been examined, have defective vision. The exactment of rules and regulations and the dissemination of knowledge relating to correct lighting conditions is one of the most important needs of our educational institutions and legislative bodies. While the Code is intended primarily as an aid in formulating legislation relating to the lighting of school buildings, it is also intended for school authorities as a guide in individual efforts to improve lighting conditions.

PERCENTAGE OF EXTRACTION OF BITUMINOUS COAL WITH SPECIAL REFERENCE TO ILLINOIS.—This is the title of a bulletin by C. M. Young published by the Engineering Experiment Station of the University of Illinois. The purpose of the discussion presented in this bulletin is to record the results now being obtained in recovering coal in the mines of Illinois and in other bituminous coal mining districts of the United States. The percentage of total available coal recovered in the process of mining is a factor of increasing importance under the present conditions when the demand for fuel is so abnormally high. Under the belief that the percentage of extraction at present is too low, especially in the mining of bituminous coal, the Engineering Experiment Station of the University of Illinois, in co-operation with the Illinois State Geological Survey and the U. S. Bureau of Mines, has undertaken an investigation of the subject and has made a somewhat elaborate study of the facts and information compiled. The work has been done under the immediate direction of Professor C. M. Young of the Department of Mining Engineering at Urbana and the results are published as Bulletin 100 of the Engineering Experiment Station. The facts developed show that mining methods in many districts of West Virginia and Pennsylvania are yielding, under comparable conditions, a much higher percentage of extraction than those employed in the Illinois, Indiana and western Kentucky field. It is shown that there is an excellent opportunity to improve conditions in the Middle West field by more systematic methods of mining. Copies of Bulletin 100 may be had without charge by addressing the Engineering Experiment Station, Urbana, Ill.

PROPOSALS

ELECTRIC METERS.—Bids will be received March 22 for 1333 electric meters for Division of Light & Heat of Cleveland, Ohio, to range from 5 amperes, 110-volt, single-phase, to 2200 amperes. Transformers with a 110-volt potential will be requested. Address city purchaser, City Hall.

TRAVELING BRIDGE CRANE.—Sealed proposals for a 10-ton traveling bridge crane will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., on March 25 to be installed on existing runways in the storage shed at the naval station, New Orleans, La. Address C. W. Parks, chief of bureau.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

ELECTRICAL APPARATUS AND SUPPLIES (No. 26,421).—The owner of an electric plant in Abyssinia is in the market for electrical apparatus and supplies for the enlargement of his plant. Complete list and specifications of machinery and supplies desired may be had on application to the Bureau or its district offices.

MOTOR CYCLES, ELECTRIC FANS AND SAFES (No. 26,538).—A company in China desires to purchase motor cycles, electric fans and safes. It also wishes to entertain an agency proposition for the sale of these goods. Payment will be made by letter of credit or cash when so required.

INCORPORATIONS

BROOKLYN, N. Y.—Rubes Electric Lamp Works. Capital, $10,000. To manufacture electric lamps, etc. Incorporators: A. Wegmann, N. and L. Rubes, 1585 Bedford avenue.

NEW YORK, N. Y.—Kosmotie Manufacturing Corporation has incorporated. Capital, $30,000. To manufacture lighting fixtures, etc. Incorporators: W. Kosman, M. Samuels, and M. C. Klein, 1384 Fifth avenue.

NEW YORK, N. Y.—Lowenstein Radio Company. Capital, $500,000. To manufacture wireless apparatus, etc. Incorporators: F. Lowenstein, A. Harris and H. G. Bilson, 233 Broadway.

NEW YORK, N. Y.—J. S. Murphy Company, Inc., was recently incorporated with a capital of $10,000 to act as electrical engineers, etc. Incorporators: E. J. Healy, E. V. McGovern, and J. S. Murphy, 353 East Seventy-eighth street.

SOUTH BEND, IND.—Columbia Battery Company has been incorporated with capital of $10,000 to manufacture storage batteries. The directors will be Otto M. Knoblock, Frank L. Stedman and William B. Starr.

RACINE, WIS.—Webster Electric Company has incorporated with a capital of $600,000. Walter Brown, P. G. Crewe and John B. Simmons are the incorporators.

DOVER, DEL.—The National Electrical Appliance Company. Capital, $500,000. To manufacture electrical specialties. Incorporators: M. M. Clancy, C. L. Rimlinger, and F. A. Armstrong, Wilmington.

NEW YORK, N. Y.—The Benson Electric Company, Inc. Capital, $250,000. To manufacture electrical supplies. Incorporators: R. Goldman, A. H. Bloch, and H. S. Leman, 112 Taylor street, North Brighton.

NEW YORK, N. Y.—The Duplexalite Corporation. Capital, $275,000. To manufacture electrical fixtures, etc. Incorporators: L. Roche, L. C. Bunzl, and H. O. Walter, 60 Wall street.

Financial News

Union Traction Financial Report.

The annual report to the stockholders of the Union Traction Company of Indiana showed a deficit of $17,649.23. Total operating revenues were $3,066,466.51 and total operating expenses were $2,023,-609.93, but taxes, interest on bonded indebtedness, rentals, sinking funds, and other charges reduced the net operating revenue of $1,042,856.68 into a deficit of $17,649.23. The company expended during the year $169,097.64 for improvements, the principal items being on track, buildings and land. The company also placed in operation block signals on 26.35 miles of track, at a cost of $41,579.52, the additions giving the road 75.06 miles of block signal protected track. An improvement to be completed in 1918 includes the construction of a transmission line and other apparatus for operating the Muncie-Portland line with power from the central power house at North Anderson, Ind. The company made extensive improvements on both track and power facilities at Fort Benjamin Harrison, near Indianapolis, and concentrated its equipment not needed elsewhere for use at that cantonment. As this camp was designed primarily for summer training only one regiment was stationed there in November and December, thus cutting down certain revenues which the company might have obtained from the Fort Benjamin Harrison line had the cantonment been filled with men all the year. The same fact will cause a corresponding decrease in earnings in January, February and March, 1918.

Commonwealth Power Earnings Show Decrease.

The Commonwealth Power, Railway & Light Company, in issuing its January earnings statement, presents an interesting exhibit of the effect on earnings of the increase in operating costs. Operating expenses increased 42.23 per cent and net profits after all charges decreased 133 per cent, causing the month to show a deficit.

While this is an exceptional case as to percentages, the experience of the company is typical of the utilities. The report says:

"As an indication of the increased cost of operating the properties because of the weather and coal shortage in January, 1918, over January, 1917, the following statement is appended:

Increased cost of coal for electric plants	$ 51,000
Increased cost of coal for steam heating	43,000
Increased cost of gas, coal and oil	91,000
Increased cost of snow removal..	53,000
Increased cost of car repairs	22,000
Total	$260,000

These figures indicate that of a total operating expense of $1,192,647 the increase over January, 1916, was represented by $260,000.

Garland Corporation to Reorganize.

The Garland Corporation, Pittsburgh, Pa., is sending to its bondholders and stockholders, also to the general creditors of the company and its subsidiaries, copies of its Plan of Reorganization. The plan contemplates the organization of a new company under the laws of Pennsylvania, which will acquire, directly or indirectly, the assets of the Garland Corporation, Safety-Armorite Conduit Company, Garland Nut. & Rivet Company and West Pittsburgh Realty Company, and to the extent and in the manner provided for in the plan, the assets or securities of Woodhouse, Bopp & Company. The new company will authorize full paid non-assessable capital stock in the following classes and approximate amounts: First preferred 6 per cent cumulative stock, $1,589,300; second preferred 5 per cent non-cumulative stock, $1,250,000, and common stock, $1,-500,000. Detailed information in regard to the plan of reorganization of the Garland Corporation and subsidiary companies is contained in this booklet.

Electric Line Loan Extended.

B. P. Alschuler, counsel for the Aurora, Elgin & Chicago Electric railroad, which operates over several hundred miles of track in northeastern Illinois, has announced that the railroad had been saved from going into bankruptcy by the state public utilities commission, sanctioning an arrangement by which Chicago bankers give the road another year to meet $800,000 in notes due March 1. The state board recently granted the electric railroad permission to increase its interurban rates.

Alabama Power Bonds Offered.

The Alabama Power Company, through the Harris Trust & Savings Bank, is offering $1,000,000 of first mortgage 30-year 5 per cent bonds at a price of 85 and yielding about 6¼ per cent. This company supplies electric light and power to the major part of northern Alabama, including the Birmingham district, serving a population estimated at over 400,000. The company derives 85 per cent of its power from modern water plants and also controls water power sites aggregating 100,000 additional horsepower. The gross earnings of this concern are nearly ten times those of five years ago, and in 1917 reached a total of $1,360,624, showing a marked increase over 1916.

Louisville Gas & Electric Notes Issued.

The Louisville Gas & Electric Company of Louisville, Ky., a subsidiary of the Standard Gas & Electric Company, under the management of H. M. Byllesby & Company, has sold a new issue of $1,-600,000 7 per cent two and one-half year secured notes. The proceeds will be used chiefly for retiring notes which mature April 1 next. The new notes which mature September 1, 1920, have been offered to the public by H. M. Byllesby & Company, Bonbright & Company and Wakefield & Company, of Louisville, at 97¾, to yield 8 per cent. The notes are secured by deposit of the company's mortgage bonds, pledged with the trustees in the principal amount of 133⅓ per cent of the par value of the notes.

Indicated Profits on Copper After War.

If the war continues during 1918, net profits on copper production, based on refinery output and the prevailing Government price of 23.50 cents a pound, should amount to $195,500,000, compared with pre-war period yearly averages of $75,000,000 (1910 to 1915). An estimate of taxes under the war revenue act amounting to 2½ cents a pound (which is probably too high) would reduce 1918 earnings to $138,000,000. Yearly refinery output after the war will probably average 1,600,000,000 pounds, against present average (yearly 1916 and 1917) of 2,300,-000,000 pounds. Indicated yearly future earnings based on 23.50 cents copper and estimated 1918 production costs of 15 cents a pound should exceed $100,000,-000. The comparison is as follows:

	Average price received.	Average costs.	Net profit.	Total profits.
1910	13.00	9.00	4.00	$ 58,084,884
1911	12.70	9.00	3.70	52,981,718
1912	15.85	9.00	6.85	108,361,539
1913	15.30	9.00	6.30	102,214,402
1914	13.45	9.00	4.95	75,922,179
1915	17.50	9.00	8.50	138,907,378
1916	26.25	9.67½	16.57½	374,493,447
1917	26.50	14.00	12.50	295,250,000
1918*	23.50	15.00	8.50	195,500,000

*Price of 23.50 cents is Government price to June 1, 1918, and used here as the basis for this year.

Refinery rather than smelter figures will provide for imports of American companies operating outside the U. S. A.

Production costs are based upon actual costs of 69 companies. The actual costs on companies producing two-thirds of total is around 11 cents.

Water Power Officials Re-elected.

D. L. Huntington, of Spokane, was re-elected president of the Washington Water Power Company at a meeting of the trustees in New York City recently. H. L. Bleecker was elected vice-president and C. S. MacCalla vice-president and general manager. W. J. C. Wakefield, of Spokane, was again named as chairman of the Executive Committee, and William A. White, of New York, was re-elected chairman of the Finance Committee. A. F. S. Steele and Y. M. White were again made secretary and treasurer respectively.

Semet-Solvay Income Report.

Income account of the Semet-Solvay Company for year ended December 31, 1917, and for the eleven months ended December 31, 1916, show the following results of operations:

	Year ended December 31, 1917.	11 months ended December 31, 1916.
Gross earnings	$8,330,258	$10,983,918
Interest	99,974	28,985
Depreciation and adjustment of accounts	1,178,782	418,321
Income and excess profits taxes	3,300,000	.....
Balance	$3,761,302	$10,536,612
Dividends	1,599,992	1,300,000
*Surplus	$2,161,510	$ 9,236,612

*As of December 31, 1916, undivided earnings totaled $8,487,845, which was increased to $10,132,423 by addition of $1,644,578, adjustment in amount of amortization written off prior to December 31, 1916. Out of this total, $2,000,000 was paid as a special dividend on April 16, 1917, leaving a balance of $8,132,423, which added to the above surplus of $2,-161,510 made a total surplus of $10,293,933. Reserves totaling $666,028 were set aside from total surplus, leaving a balance of $9,627,906 as of December 31, 1917.

Dividends.

Electric Storage Battery Company has declared a quarterly dividend of 1 per cent, payable April 1 to stock of record March 18.

Canadian General Electric Company has declared a quarterly dividend of 2 per cent, payable April 1 to stock of record March 15.

The board of directors of the Central States Electric Corporation has declared a quarterly dividend of 1¾ per cent on the preferred stock, payable April 1 to stockholders of record March 9.

Buffalo General Electric Company has declared a quarterly dividend of 1¾ per cent on common stock, payable March 30 to stockholders of record March 20.

Electric Storage Battery Company has declared quarterly dividends of 1 per cent on common stock, and 1 per cent on preferred stock, both payable April 1 to stock of record March 18.

United Light & Railways Company has declared a quarterly dividend of 1½ per cent on preferred stock and 1 per cent on common stock, both dividends payable April 1 to stock of record March 15.

Western Electric Company has declared a quarterly dividend of $2.50 per share on the common stock, increasing the annual rate from $8 to $10. The dividend is payable March 30 to stock of record March 23. The regular quarterly dividend of 1½ per cent on preferred stock was also declared, payable March 30 to stock of record March 23.

West End Street Railway Company has declared a semi-annual dividend of $1.75 on common stock, payable April 1 to stock of record March 21.

Springfield Railway & Light Company has declared a quarterly dividend of 1¾ per cent on preferred stock, payable April 1 to stock of record March 15.

Duluth-Superior Traction Company has declared the regular quarterly dividend of 1 per cent on preferred stock, and 1 per cent on common stock, both payable April 1 to stock of record March 16.

Dayton Power & Light Company has declared a quarterly dividend of 1½ per cent on its preferred stock, payable April 1 to stock of record March 20.

Allis-Chalmers Manufacturing Company has declared a quarterly dividend of 1¾ per cent on preferred stock, and ¾ of 1 per cent on account of back dividends due on the preferred, payable April 15 to stock of record March 30.

Earnings.

The Houston Lighting & Power Company of Houston, Tex., during the year 1917 spent $305,959.65 for betterments and extensions, according to the annual report of the company, that has just been filed with the county clerk of Harris County. The gross earnings for the year were given as $878,802.87, which exceeded the general operating expenses of $56,504.65, this item including the betterments and extensions. The visible tangible property was valued at $3,488,102.34. This includes land worth $64,364; machinery, $872,699; buildings, $181,353; equipment, $2,197,723, etc. The company has a bonded debt of $1,653,000, while the floating indebtedness is given as $214,990.

NEW ORLEANS RAILWAY & LIGHT COMPANY.

New Orleans Railway & Light Company for the twelve months ending December 31, 1917, reports gross earnings of $7,792,955; net earnings of $2,804,043; and surplus after all charges of $651,079.

MONTANA POWER COMPANY.

Net earnings of the Montana Power Company, for the year ended December 31, 1917, amounted to $4,889,032, an increase of $135,750 over 1916. Gross earnings totaled $6,912,364, as against $6,244,905 for 1916.

CENTRAL ILLINOIS PUBLIC SERVICE COMPANY.

The Central Illinois Public Service Company reports for the year ended December 31, 1917: Gross earnings, $2,448,050; operating expenses, including taxes, $1,576,392; balances, $871,658; add miscellaneous income, $26,338; net earnings, $897,996.

REPUBLIC RAILWAY & LIGHT COMPANY.

	1917	1916
December gross	$ 492,941	$ 373,412
Net after taxes	143,669	154,712
Surplus after charges	51,497	72,965
12 months' gross	4,889,915	3,987,616
Net after taxes	1,615,938	1,681,175
Surplus after charges	611,511	853,606

CONNECTICUT POWER COMPANY.

	1918	1917
January gross	$ 81,913	$ 71,166
Net after taxes	26,850	36,360
Surplus after charges	7,200	19,576
12 months' gross	881,369	753,041
Net after taxes	387,940	375,861
Surplus after charges	177,812	180,357

EASTERN POWER & LIGHT CORPORATION.

(Subsidiary Companies.)

For February— Systems	1918	1917
Reading	$278,652.12	$231,814.94
Pennsylvania Utilities	124,235.20	95,192.39
West Virginia	84,860.35	85,112.99
Claremont	28,796.65	26,462.33
Total	$516,544.32	$438,582.65

GENERAL GAS & ELECTRIC COMPANY.

(Subsidiary Companies.)

For February— Systems	1918	1917
Rutland	$ 39,754.11	$ 36,465.37
Northwest'rn Ohio	22,000.00	21,336.87
Sandusky Gas & Electric	39,901.35	45,338.18
Binghamton	34,486.00	31,240.33
Sayre	11,149.33	8,158.22
New Jersey	22,656.90	17,517.94
Interurban	724.21	897.33
Totals	$170,671.90	$160.954.24

THE LOWELL ELECTRIC LIGHT CORPORATION.

	1918	1917
January gross	$ 68,270	$ 64,751
Net after taxes	27,163	27,583
Surplus after charges	25,769	26,716
12 months' gross	727,150	650,115
Net after taxes	284,103	260,656
Surplus after charges	272,868	255,011

BLACKSTONE VALLEY GAS & ELECTRIC COMPANY.

	1918	1917
January gross	$186,695	$174,198
Net after taxes	54,289	65,138
Surplus after charges	27,631	39,774
12 months' gross	2,004,341	1,763,388
Net after taxes	630,821	755,097
Surplus after charges	325,360	452,550

NORTHERN TEXAS ELECTRIC COMPANY.

	1918	1917
January gross	$ 250,312	$ 171,100
Net after taxes	110,403	65,885
Surplus after charges	81,612	36,653
12 months' gross	2,661,325	1,950,792
Net after taxes	1,209,718	783,113
Surplus after charges	861,414	436,038

VIRGINIA RAILWAY & POWER COMPANY.

	1918.	1917.
January gross	$ 615,586	$ 525,182
Net earnings	269,035	280,463
Total income	277,407	286,847
Surplus after charges*	111,570	133,638
Seven months' gross	4,199,915	3,502,862
Net earnings	1,915,703	1,797,389
Total income	1,980,535	1,854,669
Surplus after charges*	875,987	804,844

*Before depreciation, which is written off at the end of the fiscal year.

NORTHERN OHIO ELECTRIC CORPORATION.

	1917.	Increase.
Gross	$6,469,034.65	23.66
Expenses	4,024,274.71	47.99
Net earnings	$2,444,759.94	*2.69
Fixed profits	1,522,919.17	7.85
Net profits	$ 921,840.77	*16.20
Dividend preferred stock	360,000.00	.....
Balance	$ 561,840.77	*24.08

*Decrease.

DAYTON POWER & LIGHT COMPANY.

	December— 1917.	December— 1916.	12 months ended December 31, 1917.	12 months ended December 31, 1916.
Gross earnings	$207,144	$170,104	$1,880,618	$1,613,873
Operating expenses (including depreciation and taxes)	142,092	127,125	1,266,545	999,961
Net earnings	$ 65,052	$ 42,979	$ 614,073	$ 613,912
Non-operating revenue	1,056	823	10,334	6,619
Total income	$ 66,108	$ 43,802	$ 624,407	$ 620,531
Interest on bonds	$ 15,121	$ 15,204	$ 181,620	$ 182,626
Other interest and sinking fund	10,873	5,035	124,358	53,338
Total deductions	$ 25,994	$ 20,239	$ 305,978	$ 235,964
Net income	$ 40,114	$ 23,563	$ 318,429	$ 384,567
Dividends on preferred stock	14,813	14,813	177,750	175,938
Surplus	$ 25,301	$ 8,750	$ 140,679	$ 208,629
Operating ratio	68.60%	74.73%	67.35%	61.96%

*Decrease.

WEEKLY COMPARISONS OF CLOSING BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid. Mar. 5.	Bid. Mar. 12.
Adirondack Electric Power of Glens Falls, common	6	15½	16
Adirondack Electric Power of Glens Falls, preferred	6	72½	72½
American Gas & Electric of New York, common	10 +extra	88½	90
American Gas & Electric of New York, preferred	6	39¾	40
American Light & Traction of New York, common	..	209	208
American Light & Traction of New York, preferred	6	95½	96
American Power & Light of New York, common	4	47	46
American Power & Light of New York, preferred	6	73	75
American Public Utilities of Grand Rapids, common	..	20	20
American Public Utilities of Grand Rapids, preferred	6	54	53
American Telephone & Telegraph of New York	..	107	105⅞
American Water Works & Elec. of New York, common	..	4¾	4¾
American Water Works & Elec. of New York, particip	7	12	12½
American Water Works & Elec. of New York, first preferred	..	57	59
Appalachian Power of Bluefield, common	..	2¼	2¼
Appalachian Power of Bluefield, preferred	7	20	20
Cities Service of New York, common	+extra	200	200
Cities Service of New York, preferred	6	74½	74½
Commonwealth Edison of Chicago	8	107	106
Comm. Power, Railway & Light of Jackson, common	..	22½	23
Comm. Power, Railway & Light of Jackson, preferred	6	50	49½
Federal Light & Traction of New York, common	..	5	5
Federal Light & Traction of New York, preferred	..	27	27
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	27	26
Middle West Utilities of Chicago, preferred	6	58½	58½
Northern States Power of Chicago, common	ex.div.7	61	60
Northern States Power of Chicago, preferred	ex.div.7	86½	87
Pacific Gas & Electric of San Francisco, common	..	37	36½
Pacific Gas & Electric of San Francisco, preferred	6	82½	82
Public Service of Northern Illinois, Chicago, common	7	75	75
Public Service of Northern Illinois, Chicago, preferred	6	85	85
Republic Railway & Light of Youngstown, common	4	22½	22½
Republic Railway & Light of Youngstown, preferred	6	57	58
Standard Gas & Electric of Chicago, common	..	6	6
Standard Gas & Electric of Chicago, preferred	6	24	24
Tennessee Railway, Light & Power of Chattanooga, common	..	2½	2½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	8	8
United Light & Railways of Grand Rapids, common	4	27	27
United Light & Railways of Grand Rapids, preferred	6	60½	62
Western Power of San Francisco, common	..	12	13
Western Power of San Francisco, preferred	6	48	49
Western Union Telegraph of New York	extra	89	89¾
Industrials—			
Electric Storage of Philadelphia, common	4	49	49¼
General Electric of Schenectady	8	140¾	139¼
National Carbon of Cleveland, common	8	56¼	56¼
National Carbon of Cleveland, preferred	..	130⅝	130⅜
Westinghouse Electric & Mfg. of Pittsburgh, common	+extra	42	41¾
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	63	63

*Last sale.